MONTHLY WEATHER REVIEW.

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The Monthly Weather Review is based on data from about 3500 land stations and many ocean reports from vessels taking the international simultaneous observation at Greenwich noon.

Special acknowledgment is made of the data furnished by the kindness of cooperative observers, and by Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt I. S. Kimball, General Superintendent of the United States Life-Saving Service; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Rev. L. Gangoiti, Director of the Meteorological Observatory of Belen College, Havana, Cuba.

As far as practicable the time of the seventy-fifth meridian, which is exactly five hours behind Greenwich time, is used in the text of the Monthly Weather Review.

Barometric pressures, both at land stations and on ocean vessels, whether station pressures or sea-level pressures, are reduced, or assumed to be reduced, to standard gravity, as well as corrected for all instrumental peculiarities, so that they express pressure in the standard international system of measures, namely, by the height of an equivalent column of mercury at 32° Fahrenheit, under the standard force, i. e. apparent gravity at sea-level and latitude 45°.

SPECIAL ARTICLES, NOTES, AND EXTRACTS.

THE CYCLONIC STORM OF OCTOBER 6-12, 1905, IN THE NORTH ATLANTIC OCEAN.

By Mr. James Page, Chief, Division of Ocean Meteorology. Dated February 15, 1906.

Throughout the interval covered by October 6–12, 1905, the western half of the North Atlantic Ocean was the scene of a cyclonic storm of great violence, which during the period mentioned made its way from the Caribbean Sea to the vicinity of Newfoundland. At the center of the barometric depression accompanying this storm the atmospheric pressure diminished to 27.90 inches (709 mm.). Throughout the latter part of its course the area over which winds of hurricane force prevailed attained a diameter of 600 miles, or more, and the attendant seas were so high as to seriously retard and in some cases damage even the staunchest of such of the transatlantic liners as came within the area of maximum severity, while vessels of ordinary power were obliged to heave to and remain practically unmanageable until the storm subsided.

As is usual at this season of the year, the storm was of tropical origin, the first intimation of its existence being contained in the weather report returned to the U. S. Weather Bureau by Capt. Egidio Gibelli, master of the Italian bark *Primo*, bound from Antwerp to Pensacola. The position of the bark at Greenwich mean noon (local mean time 7:35 a. m.) of October 6 was latitude 15° 2′ north, longitude 65° 58′ west, 200 miles to the southward of Porto Rico, and the master's report for the preceding 24 hours reads as follows:

> Light winds from ESE., increasing in force; between 11 a. m. and 12 noon (of October 5) the barometer fell rapidly from 29.96 to 29.90 inches, the sky at times covered by dense masses of clouds. As a precaution I hove to, with head to sea, for observation, content to sacrifice time in order to ensure safety. At 3 p. m. the barometer stood at 29.88 inches, and a dense nimbus cloud covered the northwestern sky. In about an hour the clouds commenced to break, the barometer ceased to fall, and the weather began to assume its normal aspect; proceeded on course.

The storm was felt throughout the island of Haiti on the following day. The weather report returned by Professor Scherer, Director of the Meteorological Observatory at Port au Prince, states that the sky was continuously overcast from October 1–6; at St. Nicolas Mole a furious gale from the SW. prevailed during the night of October 5–6, accompanied by exceptionally high tide and heavy seas. The gale continued without interruption throughout October 6. Three sailing vessels were driven ashore and the neighboring plantations were damaged by inundations. The total rainfall was 3.8 inches. Throughout the interior of the island the rivers overflowed their banks, inflicting great damage upon the coffee, cane, and banana crops; trees were uprooted, and houses destroyed. The inundations were especially severe in those streams rising near the Morne de Selle and on its northern slope. In Port au Prince the barometer fell to 29.72 inches.

Upon emerging from the Caribbean Sea into the Atlantic the area of low barometer and strong winds retained the small diameter which characterizes these storms as long as confined to tropical latitudes. During October 7 and 8 a number of vessels en route to and from West Indian waters must have been within easy distance of the center of the hurricane, but none report more than lowering, squally weather with barometer slightly below the average. Thus, the French cruiser *Troude*, Captain Mottez in command, left Bermuda October 5, bound for Martinique; followed a southerly course along the meridian of 64° west, passing Sombrero at midnight October 9–10. Her barometer gave no evidence of the existence of a depression in the vicinity. At 4 p. m. of October 7, position 26° north, 64° west, the wind suddenly freshened from the south, showing that the vessel had penetrated the outskirts of the cyclonic circulation, its force, however, at no time exceeding 5 on the Beaufort scale. To the westward of the line of progress, throughout October 7 and 8, the presence of the depression gave rise to a steepening of the barometic gradients extending as far as the American coast, with the result that throughout this whole region as far north as Hatteras northeasterly gales of force 8 prevailed, as shown by the reports of the *Alene* (Ger. S. S.), Wolpert; the *Caracas* (Am. S.S.), Goodrich; the *Nordfarer* (Dan. S. S.), Brunich, and numerous other vessels.

The weather conditions existing over the western half of the ocean at the instant of Greenwich mean noon of October 9 are shown by the accompanying synoptic weather chart, fig. 1. Upon this date the full violence of the storm was encountered by the *France Marie* (34[1]), bound from Gibraltar to the Capes of the Delaware by way of the trades. The characteristic features by means of which the trained observer is accustomed

[1] Number 34 in the accompanying list and on the synoptic charts. In these charts the arrows fly with the wind, the center of the arrowhead marking the position of the vessel. The number of feathers gives the force of the wind on the Beaufort scale; the shading of the head shows the proportion of clouded sky.

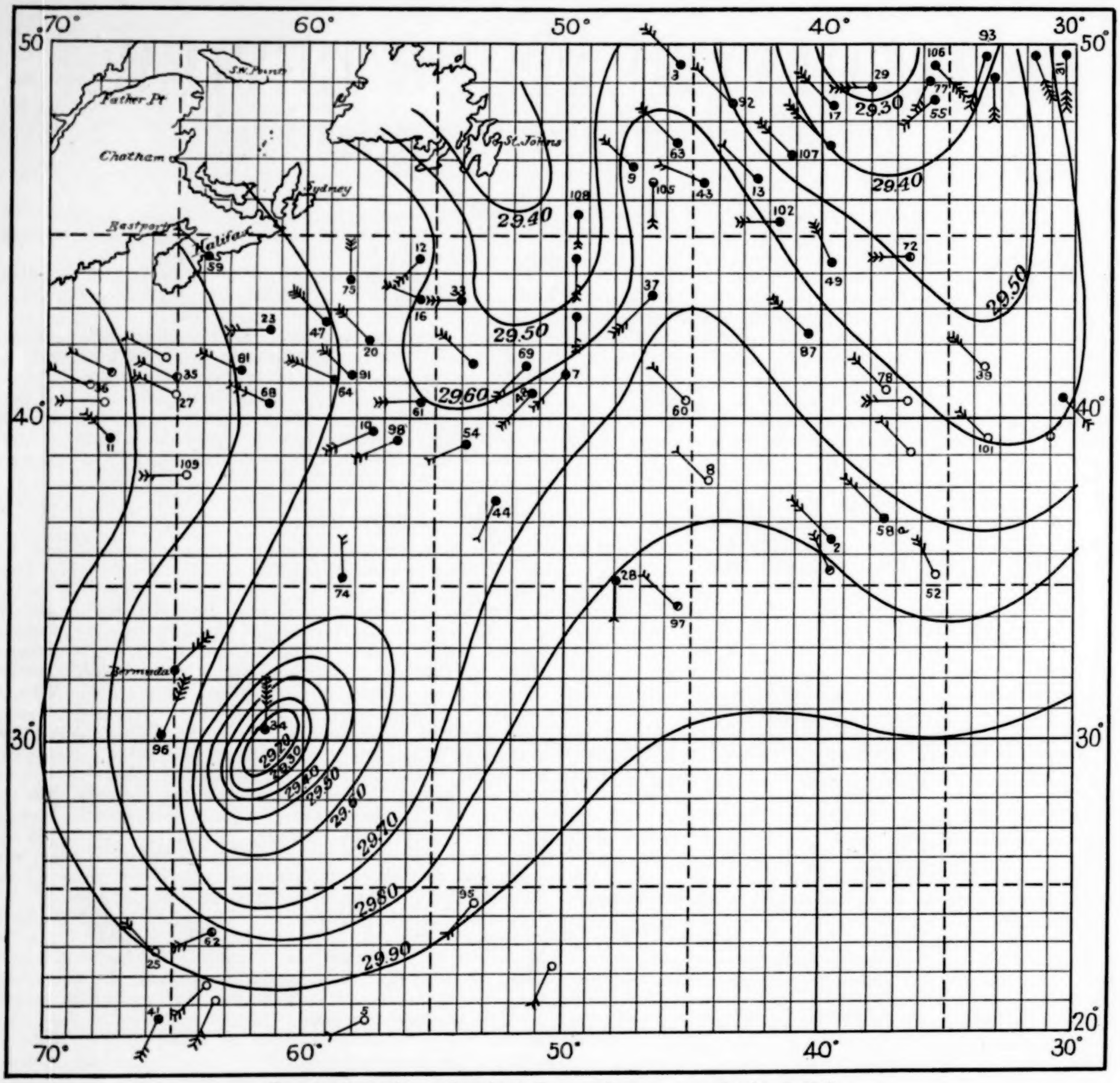

FIG. 1.—Synoptic weather chart, Greenwich mean noon, October 9, 1905.

to recognize the proximity of a severe cyclonic storm are all present in the report furnished by Captain La Croix. At Greenwich mean noon of October 8 the bark was in latitude 31° north, longitude 59° west, probably 500 miles to the ENE. of the position of the storm center at that time. The barometer stood at 30.08 inches (764 mm.), with an easterly wind of force 3; sky overcast, with fine rain and a heavy swell from the westward. Throughout the evening the wind increased to a strong breeze, but fell off somewhat during the night, with heavy rain. At daybreak of October 9 the glass had fallen to 29.88 inches (759 mm.), this preliminary gradual descent marking the entrance of the vessel into the outer circle of the storm. The radius of the hurricane proper was attained at 7:30 a. m. At this hour the wind freshened rapidly, shifting first to NE. and later to N., the barometer in the space of the next two hours falling to 29.16 inches (741 mm.). These two facts taken in conjunction would ordinarily be regarded as justifying the conclusion that the position occupied was in the forward quadrant of the storm, and that the center was rapidly bearing down upon the observer. Unless prevented by exceptional circumstances from so doing, the maneuver recommended for a vessel thus situated is to take the wind free on the starboard quarter and run. For doubtless sufficient reasons, however, Captain La Croix states that he placed his vessel before the wind under lower topsails and foresail. These sails, as also the forestaysail, were later carried away, and the bark fell off into the trough of the sea, described by the master as exceptionally heavy.

A vessel which narrowly escaped becoming involved in the storm at this stage of its development was the *Teodoro de*

Larrinaga (96), Liverpool to Havana. According to the weather report returned by Officer Carroll, the position at Greenwich mean noon of October 8 was latitude 32° 44′ north, longitude 60° 51′ west; barometer 29.92 inches; wind SE., force 6; sky overcast. Throughout the next 24 hours the course steered was WSW., bringing the vessel at Greenwich mean noon of October 9 to latitude 30° 54′ north, longitude 65° 28′ west. During the interval the wind backed to NNE. and increased to force 9, weather overcast and squally, with heavy rain. The report omits the lowest reading of the barometer, and it is consequently impossible to state with accuracy at what distance in advance of the center the steamer crossed the track.

As shown by the synoptic chart of that date, the position of the hurricane center at Greenwich mean noon of October 9 was in the neighborhood of latitude 30° north, longitude 61° west. Throughout the day it advanced steadily to the eastward, the depression meanwhile constantly deepening and increasing in size, and the area covered by winds of storm force extending further and further outward. At Greenwich mean noon of October 10 it had reached latitude 32° north, longitude 50° west, pressure at the center having meanwhile sunk to a point below 28.50 inches. No vessel, as far as known, came within dangerous proximity of the center of the storm in the course of its progress during these 24 hours. At the epoch represented by the chart of October 10 (fig. 2), however, the *Texan* (97), bound from Liverpool to Kingston, Jamaica, was on the immediate outskirts of the vortex. The indications recorded by the observer for the 24 hours preceding are thoroughly characteristic. The position of the vessel at Greenwich mean noon of October 9 (see fig. 1) was, as shown, in latitude 34° 20′ north, longitude 45° 20′ west, 900 miles, therefore, to the ENE. of the center of the hurricane as situated at that time.

The ship's day set in with a moderate southwesterly wind, a northerly swell, and weather exceptionally clear and fine, the sky being cloudless, save for rapidly forming long cirrus feathers passing quickly across from WNW. At 4 p. m. glass 29.59 and falling; wind freshening; sky rapidly clouding. At midnight, 29.38 and still falling; wind shifted to SSE. At 4 a. m. (of October 10), 29.28; wind blowing a whole gale, steady from SSE.; sea lumpy and confused. At 8 a. m., 28.58; heavy gale. At 10 a. m., 28.53; wind falling light. At noon, glass rising; wind blowing in terrific squalls in rapid succession from the north, followed by a heavy gale; sea mountainous and confused.

The *Dania* (28), Coruna to Havana, also came within the area of rapidly shifting storm winds and felt to some extent the force of the gale. The omission of a storm log, however, renders it impossible to describe the shifts of wind and variations of atmospheric pressure. In his account of the weather experienced during the 24 hours preceding the observation of October 10, (the vessel in the course of this interval passing from latitude 35°, longitude 48° to latitude 33° 28′, longitude 53° 34′), the observer states that at 2 a. m. (of October 10) heavy rain set in and the wind increased to force 10, backing from WSW. to NNE. in seven hours, with heavy rolling sea, bad and misty weather.

In the course of October 9 a second barometric depression, attended by an independent cyclonic circulation, developed to the southeastward of Newfoundland. This depression is plainly apparent on the chart of October 10, and gave rise to severe weather along the transatlantic steamship routes during the forenoon of that day. A most interesting and complete record of its progress is contained in the storm log of the *Oxonian* (76), Galveston to Bremen; the eastward advance of this vessel, situated throughout in the northern semicircle of the depression, was but slightly exceeded by that of the depression itself, as shown by the slight variation of the barometer and by the uniform but slow shift of the wind. The position at Greenwich mean noon of October 9 was latitude 44° 40′ north, longitude 49° 03′ west; wind south, 5; barometer 29.44 inches. Subsequent to this the wind backed to the eastward, reaching this point at 10 p. m., at which time following the storm log begins:

Date and time.	Direction and force of wind.	Barometer.	Remarks.
		Inches.	
October 9, 10 p. m.	East, 7	29.22	
October 9, midnight	E. by N., 7	29.18	
October 10, 2 a. m.	NE. by E., 8	29.12	
October 10, 4 a. m.	NE. by N., 9	29.07	
October 10, 8 a. m.	N. by E., 9	29.03	Clouds breaking.
October 10, noon	N. by W., 9	29.22	Weather clearing.
October 10, midnight	North, 3	29.44	Barometer rising fast, wind falling.
October 11, 2 a. m.	NE., 5	29.39	Wind hauling easterly.
October 11, 4 a. m.	East., 6	29.37	
October 11, 6 a. m.	SE., 8	29.34	Sudden shift.
October 11, noon	SE., 9	29.27	
October 11, midnight	SSE., 9	29.52	

From the above table it is apparent that the *Oxonian* was in the immediate neighborhood and to the northward of the center of the more northerly depression at 8 a. m. of October 10, and that the transition from the wind system of this minor depression to that of the greater cyclone following took place between midnight and 2 a. m. of October 11.

It is on the last-mentioned date that the latter storm developed its maximum intensity, and the fact that it was at this time about to cross the transatlantic steamship route brought many reporting vessels within its circle of influence. Several of these have furnished detailed accounts of their experience. Captain Horne of the *Indrapura* (48), New York to Gibraltar, writes as follows:

I have thought that the following account of a hurricane which this vessel has just encountered might be of some interest to you, more especially as the vessel has been involved in the center of the depression.

Our position at noon of October 10 was latitude 41° 08′ north, longitude 46° 01′ west; barometer 29.39, wind NE.; light sea, rising, from NE, taking the place of a hitherto southwesterly swell. At 4 p. m. barometer 29.31, freshening NE. breeze; rain set in. At 5:30 barometer 29.24; looking dirty; put ship with head to north and hove to solely on account of low glass in order to watch developments. At 7:30 p. m. barometer 29.18; moderate NE. gale; rising NE. sea. At 10:30 p. m. barometer 28.94; heavier rain, and gale freshening; brought wind four points on starboard quarter and engines full speed ahead; vessel making ten knots. Midnight, barometer 28.50; wind and sea increasing with great rapidity; hove ship to on the port tack, the sea being too big to run longer and fearing that we might shortly be unable to heave to at all; engines dead slow. The running of the vessel with wind on starboard quarter, combined with the more rapid fall of the glass, convinced us that we could not get across the front, especially as the wind did not shift; accordingly decided to heave to and see it out. At 2 a. m. entered the vortex; the wind fell away in a moment, but increased a few minutes later to about force 6, still NE. true, gradually falling light; the sea moderated somewhat, but confused and lumpy; the barometer continued to fall rapidly. The calm lasted for some three hours, and the barometer fell at last to 27.94 inches, this being the lowest reading. It then rose 0.10 of an inch, and the wind came out like a shot from NW. true. The wind thus shifted eight points, from which it would seem that we were not in the direct line of progression after all, as in this case it would have shifted sixteen points.

In a moment it was blowing a whole hurricane. The sea consisted of hugh masses of water (about 35 feet). They were not waves and did not look like them; just huge pointed masses of water, like a boiling pot on a very large scale, coming from all sides, but chiefly from NNE. and WNW. The worst of this was past in some twenty minutes and then the high irregular sea set in. The spoondrift made it impossible to see more than a few yards and there seemed to be a good deal of rain, but there was so much spray flying that it was difficult to say. The hurricane blew with unabated violence for some seven hours, or until the glass had risen to 29.00. By this time the wind had drawn around to SW. and it gradually cleared.

Captain Horne then draws the following conclusions, which are of value as tending to dissipate the belief in hot, moist weather, lurid sunrise and sunset, increasing ocean swell, etc., as necessary and sufficient indications of the approach of these disturbances.

1. Persistent northeast wind and sea gradually increasing, but showing no serious symptoms until within six hours of entering the vortex.

2. There had been a slightly confused sea 48 hours before the hurricane, but this had subsided, and there was none in the 24 hours immediately preceding it.

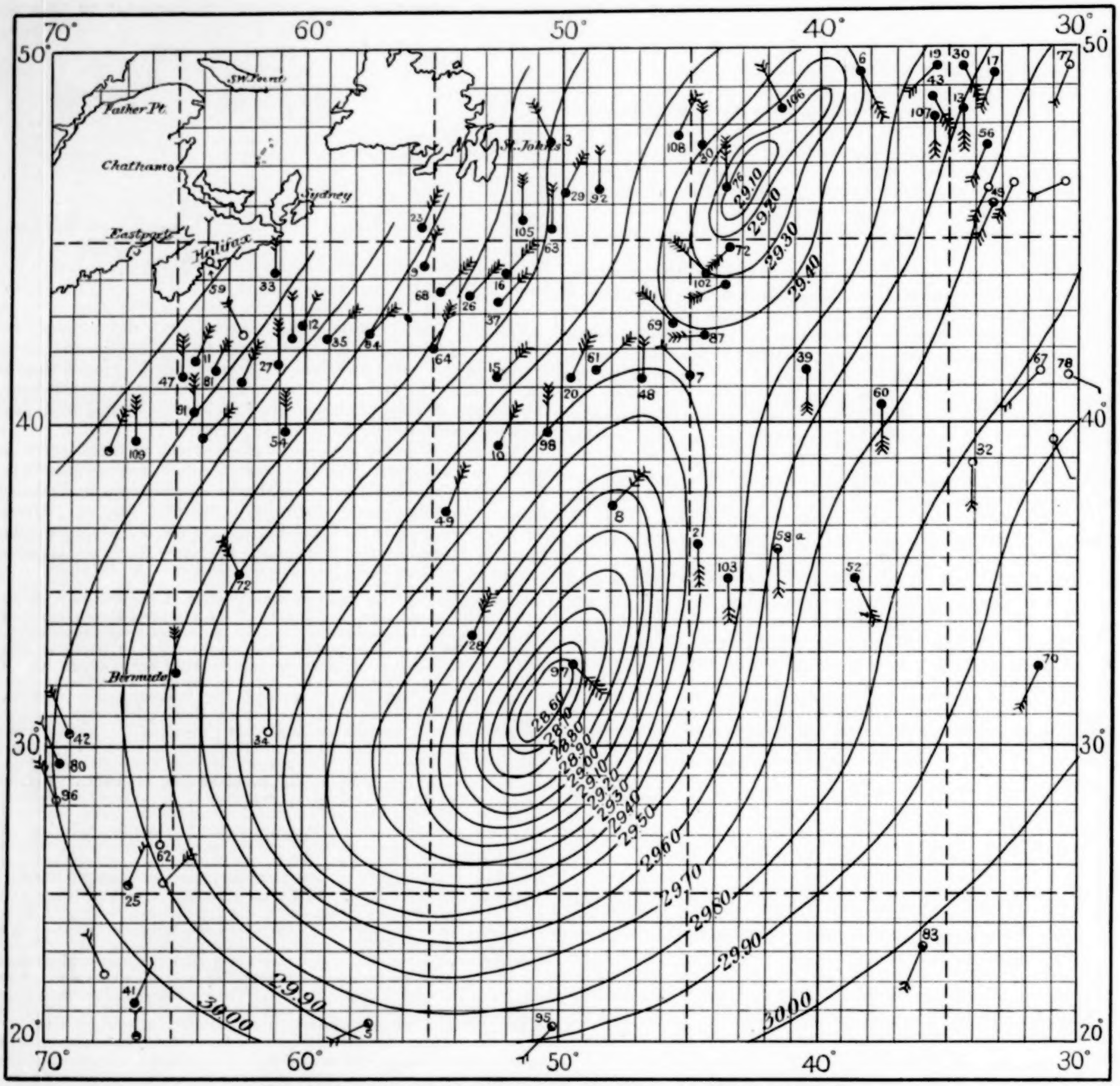

FIG. 2.—Synoptic weather chart, Greenwich mean noon, October 10, 1905.

3. The clouds presented nothing out of the common, and there was no scud. There was no oppressive heat at any time, the temperature being lower during the gale than either before or after.

4. The rainfall was not remarkable; though copious, it in no way resembled a tropical downpour.

5. Until the center had passed, the horizon was fairly clear.

6. There were no vivid tints at the preceding sunset or sunrise.

7. With the exception of the barometer, there was nothing alarming in the weather symptoms until within three hours of the vessel's entering the center.

8. Scudding to the west after the glass had fallen so low possibly made matters worse; if done at all, it should be done early.

9. The storm center was completely clouded over. There was no eye of the storm.

10. The true hurricane came only after the center had passed, and the glass had commenced to rise.

11. The wind was of such violence that after the gale large pieces of gulf weed were found at the top of the masts (100 feet) where the wind and spray had carried them.

12. For a steamer hove to, without yards and sails, there is no danger of being taken aback, and it is almost impossible for her to get stern way. For a sailing vessel the danger is very great, and she would possibly founder in the boiling water immediately on the outskirts of the hurricane.

13. This vessel was hove to, and over 130 gallons of heavy engine oil was used from water closets and small oil bags, the idea being to surround the vessel with a large oil bath. She shipped no water and, with the exception of the blowing away of dodgers and drowning of sea stock, sustained no damage, as far as can be at present ascertained.

From the above report it is evident that the center of the hurricane passed to the eastward of the *Indrapura* (48). The *Mohawk* (69), Galveston to Havre, eastward bound in slightly higher latitude than the former vessel, and for this reason enabled to hold her course a few hours longer, succeeded in crossing the front, and rode out the storm in the eastern semicircle. Her position at Greenwich mean noon of October

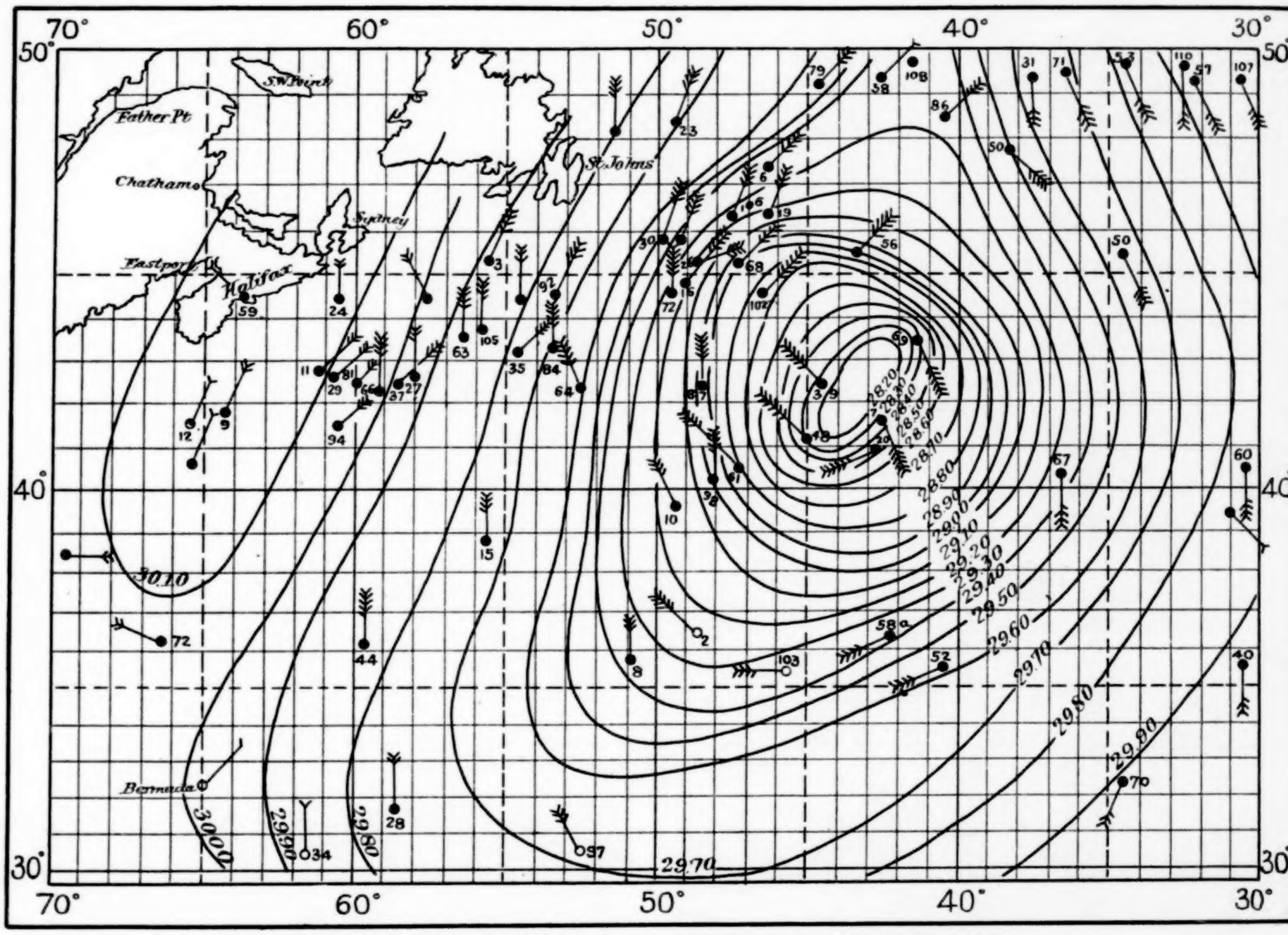

FIG. 3.—Synoptic weather chart, Greenwich mean noon, October 11, 1905.

10, was latitude 42° 33′ north, longitude 45° 56′ west; wind NW., 7; barometer 29.48 inches, rising: all tending to show that the vessel was still within the circle of the minor depression now rapidly retreating northward.

At local noon, however, the conditions had changed. The barometer, although higher (29.54 inches) than at 9 a. m., was now falling; a fresh northerly gale prevailed, with sea confused, but a heavy swell from SW. predominant. At midnight, fresh NE. gale, with fierce squalls from ENE. At 4 a. m. (October 11) barometer 28.75; wind, E., strong gale, with terrific squalls from SE. At 8 a. m., latitude 43° 30′ north, longitude 41° 50′ west; barometer 28.24 inches, this being the mean reading, as the instrument at the time was pumping violently.

At this time the hurricane struck the ship from SE., quickly raising a confused, mountainous sea; atmosphere thick with spoondrift, and unable to see further than 100 yards in any direction. With rapidly rising sea and terrific squalls, the vessel became unmanageable, being unable to heave to or run, so stopped the engines and used engine and linseed oil from three waste pipes with good results; the vessel drifting over three knots, leaving a wake to windward over which the oil spread rapidly, causing seas to curl and break before reaching the vessel.

At 10 a. m. the true sea started to make from the south with the wind in that direction, and although tremendous, was not so confused as at 8 a. m. For 21 hours the ship lay in the trough of the sea, riding the seas admirably, and taking but little water of any great weight. Wind at 8 a. m., SSE.; at noon, S.; at 6 p. m., SSW.; at midnight, SW., remaining in the latter quadrant until 6 a. m., October 12. During this gale there was but little rain, a few lightning flashes, and no thunder.

A fact of value, brought out in Captain White's report, as given above, is that the squalls invariably came from the point toward which the gale was about to shift; thus the northeast gale was interrupted by squalls from ENE., the easterly gale by squalls from SE., etc.

Another interesting report is that returned by the *Germania* (39), Marseilles to New York, the vessel apparently having crossed the path of the storm immediately in advance of the center. Her position at Greenwich mean noon of October 10 (see fig. 2) was latitude 41° 47′ north, longitude 40° 28′ west; strong breeze from the south, with heavy sea. As vessel and storm center neared each other the wind went first to NE. and thence to SE., blowing from the latter direction in violent squalls. During the evening watch the breeze freshened and the glass fell rapidly. At 2 a. m. the hurricane burst upon the vessel with terrific force from NE., sea high from all directions, but enormous from NW. At 8 a. m. barometer 28.11 inches (714 mm.), the wind hauled to NW. At 9 a. m. the barometer rose to 28.23 inches (717 mm.), thick mist, fine rain, and wind still blowing with hurricane force.

During this foul weather the wind shifted in a direction contrary to the motion of the hands of a watch; the heaviest sea came from a northerly direction, varying from NNE. to NNW.; the gale attained its maximum force between 5 and 6 a. m.; the lowest point reached by the barometer was 28.11 inches (714 mm.). The sky was covered throughout, with fine rain and mist.

The record of the self-recording aneroid aboard the *Germania* is given in fig. 5. The record of the similar instrument aboard the *La Savoie* (56) is also shown (see fig. 6). Greenwich time is employed in both instances. The latter vessel, westward bound like the former, also succeeded in crossing the path of the storm in advance of the center. The record for the 24 hours following Greenwich mean noon of October 10 is interesting, as showing the transition of the vessel from the rear semicircle of the preceding cyclonic area shown upon

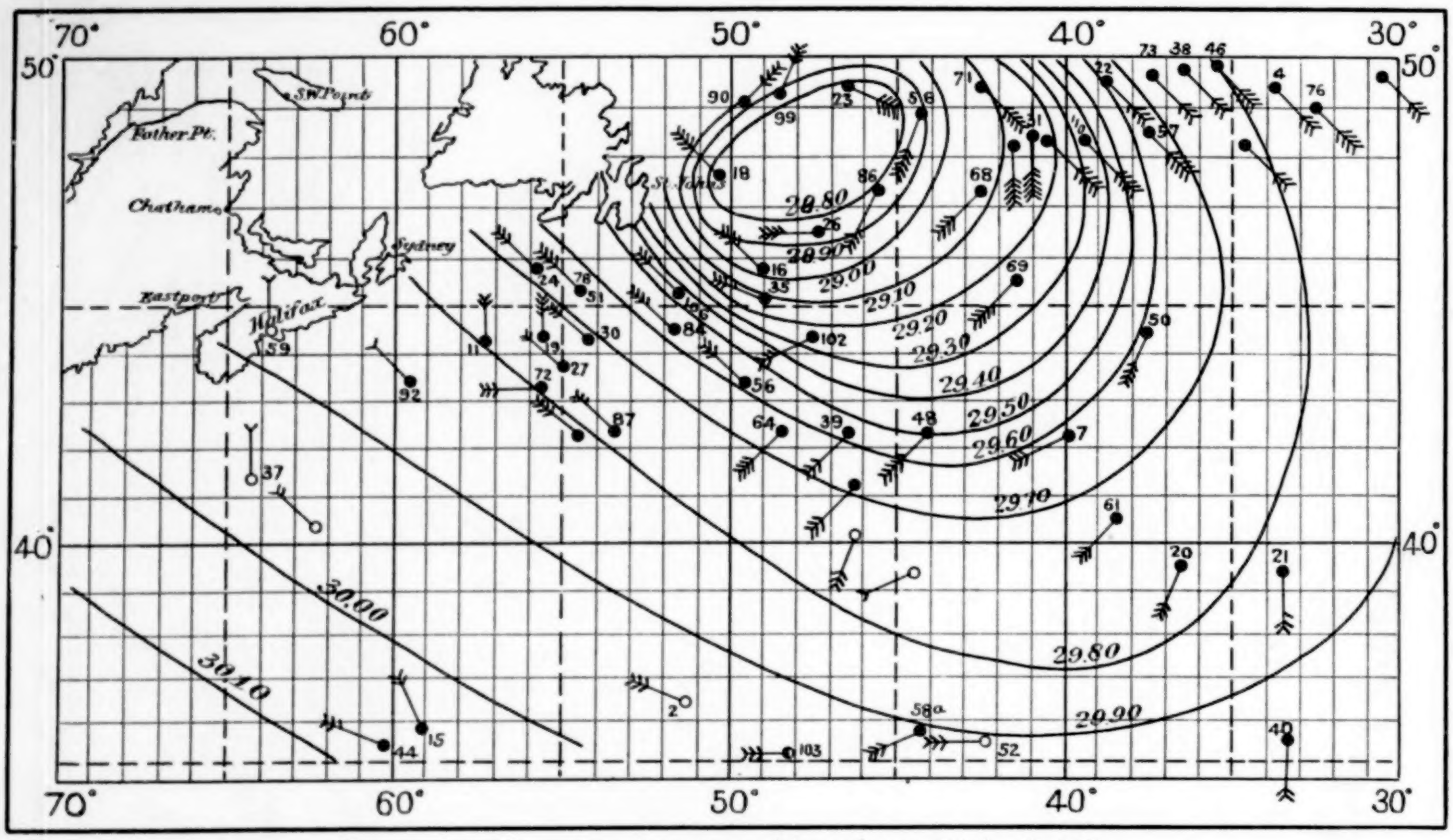

FIG. 4.—Synoptic weather chart, Greenwich mean noon, October 12, 1905.

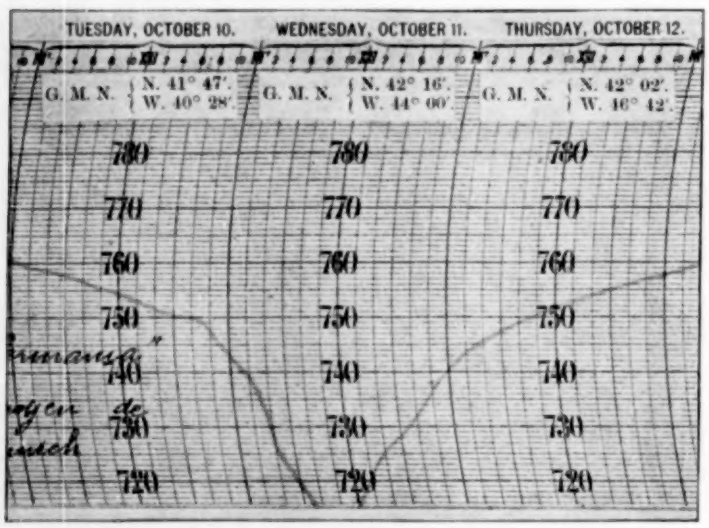

FIG. 5.—Barogram from aneroid on S. S. *Germania*.

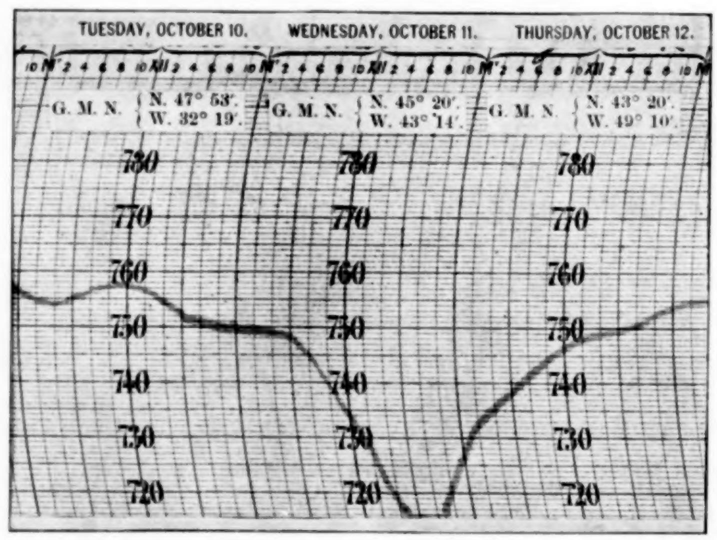

FIG. 6.—Barogram from aneroid on S. S. *La Savoie*.

the chart of that date (fig. 2) to the forward semicircle of the following area. The position at Greenwich mean noon was, as shown on fig. 2, in latitude 47° 56′ north, longitude 33° 19′ west, wind SSW., 5; overcast sky, with squalls. As the vessel advanced westward into the rear of the first depression, the wind went to SSE. and later to SSW. About midnight, coincident with the passage from the wind system of the first or northern depression into that of the southern, the winds became variable and the diminution of pressure for the time being practically ceased, as shown by the self-recording aneroid. Once within the greater cyclonic area, however, the barometer again fell; the wind, which had settled at NW., went successively to NNE., NE., and ENE., constantly increasing in violence; the sea became very high and the pressure diminished rapidly. At Greenwich mean noon of October 11 the pressure was 28.82 inches (732 mm.); at local noon it had reached 28.31 inches (719 mm.), and at 3 p. m., 28.03 inches (712 mm.), the descent ceasing at this point. The position of the *La Savoie* at this time was latitude 45° 00′ north, longitude 45° 00′ west, and the shifts of the wind were successively NNE., NNW., NW., NNW., showing that the vessel was to the westward of the path pursued by the cyclonic center. The barometer meanwhile rose rapidly.

In each of the barographs shown, the depth of the depression exceeded the limit of the sheet.

The report of the *Campania* (19), Liverpool to New York, is worthy of note, this steamship having suffered damage by contact with the storm, attended by loss of life. The vessel crossed

No.	Vessel.	Captain.	Reported by—
1	Albano, Ger. S. S.	Kudenhold	II Officer Luhrs.
2	Algeria, Br. S. S.	Wards	Officer Booth
3	Almora, Br. S. S.	Turner	Officer McGavin.
4	Amsteldijk, Du. S. S.	Baron	Officer de Kup.
5	Annie M. Parker, Br. Schr.	Carter	Master.
6	Arabic, Br. S. S.	Atkin, R. N. R	I Officer.
7	Asama, Br. S. S.	Carr	Officer Myles.
8	Atlanten, Sw. S. S.	Svenson	Master.
9	Baltic, Br. S. S	Smith	Officer Simpson.
10	Bayonne, Ger. S. S.	von Hugo	Officer Frankenbusch
11	Belfast, Br. S. S.	McKee	III Officer Noble.
12	Black Prince, Br. S. S.	Sheppard	III Officer Jackson.
13	Bluecher, Ger. S. S.	Reessing	IV Officer Bauer.
14	British Empire, Br. S. S.	Riddle	Officer Bender.
15	British Trader, Br. S. S.	Hutchinson	Officer Williams.
16	Brooklyn City, Br. S. S.	Bailey, R. N. R	Officer Stoton.
17	Bovic, Br. S. S	Kerr	Officer Harbord.
18	Caledonian Br. S. S	Baxter	III Officer.
19	Campania, Br. S. S.	Ware	Officers Horsburgh & Porley.
20	Canopic, Br. S. S.	Bartlett, R. N. R	Officer Thomas.
21	Cayo Manzanillo, Br. S. S	Winter	Master.
22	Cestrian, Br. S. S	Thomas	Officer Harker.
23	Columbia, Br. S. S	Wadsworth	Officer Paulesen.
24	Contre Amiral Caubet, Fr. S. S.	Degrand	Officer Gallocher.
25	Corfe Castle, Br. S. S.	Nutman	Officer Blanchard.
26	Cornishman, Br. S. S	Thornton	Officer Wormald.
27	Crown Point, Br. S. S.	Wall	II Officer.
28	Dania, Ger. S. S	Bonath	Officer Nachtwey.
29	Deutschland, Ger. S. S	Kaempff	Officer Vimcker.
30	Elise Marie, Ger. S. S	Stege	Officer Sievers.
31	Elswick Hall, Br. S. S.	Cripsey	Officer Berg.
32	Emilia, Port. Bk	Domingues	Officer Cochat.
33	Excelsior. Ger. S. S	Courtin	Officer Meyer.
34	France Marie, Fr. Bk	La Croix	Master.
35	Friesland, Bel. S. S.	Rogers	Officer Alford.
36	Furnessia, Br. S. S.	Blaikie	Master.
37	Gallia, Fr. S. S	Bouleuc	II Officer.
38	Georgic, Br. S. S.	Clarke	Officer Browne.
39	Germania, Fr. S. S	Jaubert	Officer Latil.
40	Gibraltar, Br. S. S	Knagg	Officer Pegdenn.
41	Glooscap, Br. Sp.	Spicer	Master.
42	Grenada, Br. S. S.	Murchison	Master.
43	Grosser Kurfurst, Ger. S. S.	Mentz	Officer Siebert.
44	Hainaut, Du. Sp	Jacobs	Officer Schwede.
45	Horta, Azores		
46	Iberian, Br. S. S.	Jago	Officer Harris.
47	Indore, Br. S. S.	Mytton	Officer Stancliffe.
48	Indrapura, Br. S. S	Horne	Officer Barston.
49	Iowa, Br. S. S.	Walters	Officer Jackson.
50	Iris, Bel. S. S	Sytor	Officer Achtergael.
51	Kaiser Wilhelm II, Ger. S. S.	Hogemann	Officer Mahlmann.
52	Knight of St. George, Br. S. S	Stephens	Officer Hogan.
53	Koln, Ger. S. S.	Konemann	Officer Werther.
54	Konigin Luise, Ger. S. S.	Volger	Officer Elsner.
55	La Lorraine, Fr. S. S	Alix	Officer Guerin.
56	La Savoie, Fr. S. S.	Poirot	Officer Sous.
57	Le Coq, Br. S. S	Peterson	II Officer.
58	Lucifer, Br. S. S.	Prowse	Officer Colvin.
58a	Lustleigh, Br. S. S	Bootyman	Officer Cuthford.
59	Mackay-Bennett, Br. S. S.	Schenk	Officer Richardson.
60	Madonna, Br. S. S	Lander	Officer McKay.
61	Manuel Calvo, Sp. S. S.	Castella	Officer Morales.
62	Maranhense, Br. S. S	Casey	Officer Arrowsmith.
63	Martello, Br. S. S	Schekell	Officer Massam.
64	Matteawan, Br. S. S.	Bennett	Master.
65	Mesaba, Br. S. S.	Tubb	Officer Beresford.
66	Mexican, Br. S. S.	Slater	Officer Chirgwin.
67	Michigan, Br. S. S	Stapleton	Officer d'Auquier.
68	Minnehaha, Br. S. S	Robinson	Officer Lewin.
69	Mohawk, Br. S. S.	White	III Officer.
70	Mokta, Br. S. S.	Cooper	Officer Lawson.
71	Mount Temple, Br. S. S.	Forster	Officer O'Reilly.
72	Napolitan Prince Br. S. S.	Eagleton, R. N. R.	Officer Campbell.
73	Noordam, Du. S. S.	Bonjer	Officer Paun.
74	Obi, Br. S. S	Evans	Officer Jones.
75	Oldenburg, Ger. S. S.	Troitrich	III Officer.
76	Oxonian, Br. S. S.	Dickinson	Officer Lawson.
77	Pectan, Br. S. S.	Daniel	Officer Yeomans.
78	Perugia, Br. S. S.	Johnston	Officer Bewsher.
79	Philadelphia, Am. S. S	Mills	Officer Dorry.
80	Ponce, Am. S. S.	Dalton	Officer Mundy.
81	Potomac, Br. S. S	McKay	Officer MacDonald.
82	Primo, It. Bk.	Gibelli	Master.
83	Quevilly, Fr. Bk	Ladonne	Officer Carpentier.
84	Rappahannock, Br. S. S.	Buckingham	Officer Allman
85	Rhein, Ger. S. S	Rott	Officer Reher.
86	Sachem, Br. S. S	Murdoch	Officer Lowe.
87	Saint Hugo, Br. S. S.	Stabb	Officer Hudson.
88	Santa Cruz, Azores		
90	Siberian, Br. S. S	Eastaway	Officer Paterson.
91	Sicilia, It. S. S	Sartorio	Officers.
92	Standard, Ger. S. S	Sluiter	Officer Schulte.
93	Sylvania, Br. S. S.	Cresser	Officer Hughes.
94	Templemore, Br. S. S.	Henry	Officer Candlish.
95	Tennyson, Br. S. S.	Ohls	Officer Alexander.
96	Teodoro de Larrinaga, Br. S. S.	Hudson	Officer Carroll.
97	Texan, Br. S. S.	Land	Officer Martin.
98	Traveller, Br. S. S.	Donald	Officer Turgoose.
99	Trebia, Br. S. S.	Hilton	Master.
101	Tuscarora, Br. S. S.	Hollingshead	III Officer.
102	Vera, Br. S. S.	Dunstan	Officer Olsen.
103	Virginia, Br. S. S.	Reid	Officer Lane.
104	Virginia, Ger. S. S.	Rauschenplat	Master.
105	Wells City, Br. S. S	Carey	Officer Brooks.
106	Welshman, Br. S. S.	Kay	Officer Popham.
107	West Point, Br. S. S.	Robertson	Officer Lloyd.
108	Willkommen, Ger. S. S	Lotze	Officer Hollander.
109	Yarborough, Br. S. S.	Turner	Officer Gunn.
110	Zeeland, Br. S. S.	Broomhead	Officer Möller.

the rear of the preceding depression during the afternoon and night of October 10, entering the system of winds surrounding the succeeding depression at 4 a. m. of October 11. At this hour the wind, hitherto moderate from NW., freshened from NE., with overcast sky and falling glass; at 8 a. m. a strong NNE. gale prevailed, with rough sea; at 4 p. m. a whole gale set in, blowing with violent squalls, and accompanied by a high and dangerous sea. Similar weather and conditions prevailed until 2:45 a. m. of October 12, at which hour the wind backed to north, gradually declining in force until 8 a. m., when it sank to a moderate gale (see fig. 4).

Subsequent to midnight of October 12, the storm seems to have diminished materially in energy, although no reports have been received from vessels in the immediate vicinity of the center on that date. Several, however, among them the *Caledonian* (18), the *Columbia* (23), and the *Arabic* (6), crossed the track at no great distance from the center without experiencing especially severe winds.

The reports furnished by the vessels and island stations named in the list preceding have been utilized in the preparation of the present account of the storm. The numbers attached to the observations shown on the daily synoptic charts (figs. 1, 2, 3, 4) agree with those given in the preceding list.

IMPROVED METHODS FOR FINDING ALTITUDE AND AZIMUTH, GEOGRAPHICAL POSITION, AND THE VARIATION OF THE COMPASS—SECOND ARTICLE.[1]

By "X."

The widespread movement to abolish calculation in determining a ship's place at sea from observations of the altitude of celestial bodies is making progress. It is necessary also to provide methods which, by being rid of restrictions as to the situation of the observed body in the firmament that were involved in the old routine of calculating morning and evening spherical triangles, are capable of meeting the need for such frequent determinations of both geographical position and true bearing as are now requisite in consequence of the increased speed of ships. As a further evidence of progress in these efforts, attention must be called to the tables of Victor Fuss, who until his recent retirement was director of the Imperial Naval Observatory at Kronstadt, and also to the abacus, or diagram, constructed by MM. Favé and Rollet de l'Isle, hydrographic engineers in the naval service of France.

In remarking upon the principles of some tables that he had computed for the purpose of relieving the tedium of numerical and logarithmic computation in finding the Sumner line at sea, Sir William Thomson, now Lord Kelvin, long ago said:[2]

> When we consider the thousands of triangles daily calculated on all the ships at sea, we might be led for a moment to imagine that everyone has already been solved, and that each new calculation is merely a repetition of one already made; but this would be a prodigious error, for nothing short of accuracy to the nearest minute in the use of data would thoroughly suffice for practical purposes. Now, there are 5400 minutes in 90°, and therefore there are 5400^3, or 157,464,000,000 triangles, to be solved for a single angle. This, at 1000 fresh triangles per day, would occupy above 400,000 years. Even with an artifice such as that to be described below, for utilizing solutions of triangles whose sides are integral numbers of degrees, the number to be solved (being 90^3, or 729,000) would be too great, and the tabulation of the solutions would be too complicated. * * *

A recent article in the MONTHLY WEATHER REVIEW, entitled "Improved methods for finding altitude and azimuth, geographical position, and the variation of the compass," takes occasion to point out that Mr. Littlehales, hydrographic engineer of the U. S. Hydrographic Office, has constructed and is now about to publish graphical tables in which the solutions of the spherical triangle for values varying from minute to

[1] The first article on this subject by "X" will be found in the Monthly Weather Review for June, 1905.

[2] Proceedings of the Royal Society (of London), Vol. XIX, 1870-1871, p. 260.

minute of arc are conveniently provided for, not only within the one quadrant of the sphere to which the above calculation by Lord Kelvin relates, but throughout the whole circuit of the sphere. The same article gives a description of the numerical tables that have been published by Professor Souillagouet, of the French Navy, which are very similar to those proposed by Fuss and described by him in the Proceedings of the Seventh International Geographical Congress at Berlin in 1899, in a communication entitled "Table for determining the altitudes and azimuths of stars."[3]

A comparison between the tables of Fuss and Souillagouet reveals in the former a somewhat greater ease of manipulation on account of superior arrangements of the columns and the presence of tables of differences to facilitate interpolation. Both have adopted the same method of dealing with the problem, viz: by decomposing into two right-angled spherical triangles the triangle of position, in which the known elements are the angle at the pole, the codeclination, and the colatitude, and then solving the two right triangles separately. The method of Fuss depends upon the following formulæ:

$$\operatorname{Sin} a = \cos d \sin t; \ \cot b = \cot d \cos t.$$
$$\operatorname{Sin} h = \cos a \sin B; \ \cot A = \cot a \cos B,$$

where t = angle at pole,
d = declination of star,
h = altitude of star,
A = azimuth of star,
φ = latitude of observer,
a = perpendicular from position of star to meridian of observer,
b = complement of side included between the foot of perpendicular and the pole,
$B = b + 90 - \varphi$.

The first entry in a table, in which t, the angle at the pole, is the upper horizontal argument, and d is the vertical argument, gives a and b. Then having computed B, as indicated by its definition, enter the same table a second time with B as the horizontal argument, and a as vertical argument. The star's altitude and azimuth will be found in the columns, a and b, respectively.

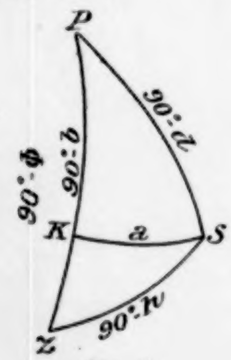

FIG. 1.

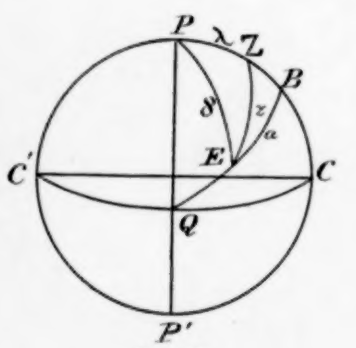

FIG. 2.

The table of Fuss is computed for every whole minute of time in hour angle, and every whole degree of declination, while Souillagouet's table is for every two minutes of hour angle, and every thirty minutes of declination.

The table of Fuss also differ from Souillagouet's in that the latter has the declination for the upper horizontal argument, and the hour angle for vertical argument, and, further, instead of giving finally the azimuth and altitude, it gives the amplitude and altitude.

The abacus of Favé and Rollet de l'Isle (see fig. 6) is also founded upon processes that effect an indirect solution of the astronomical triangle by decomposing it into two partial right-angled spherical triangles.

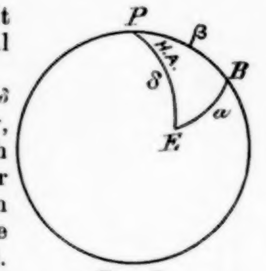

FIG. 3.

Let PZE be an astronomical triangle, δ being codeclination of the observed body, $\lambda = PZ$, the colatitude, $z = EZ$, the zenith distance or coaltitude, and EPZ the hour angle. Drop a perpendicular from E on PZ, produced if necessary, and designate PB by β and EB by a. Then $ZB = \beta - \lambda$.

The abacus (see fig. 4) provides for obtaining the two legs of a right spherical triangle when the hypotenuse and one angle are known, and conversely it provides for obtaining the hypotenuse and one angle when the two legs are known. In the right spherical triangle BPE (see fig. 3) if δ and the hour angle $H. A.$ are known a and β may be found. In the right spherical triangle ZEB, a is now known and also $ZB = \beta - \lambda$. Hence EZ, the zenith distance, may be found.

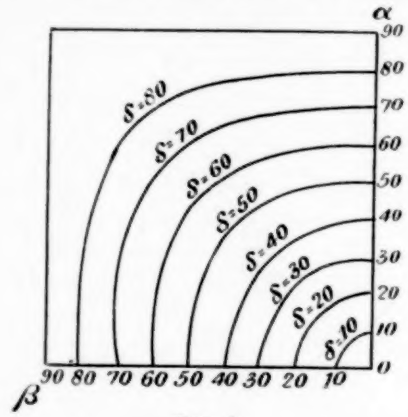

FIG. 4.

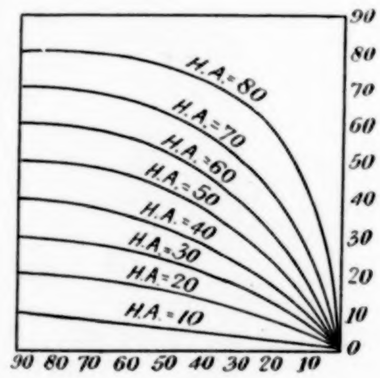

FIG. 5.

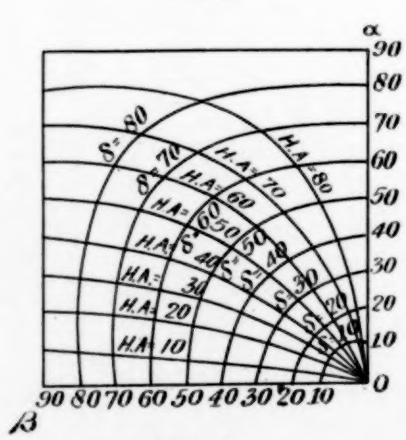

FIG. 6.

[3] We understand that the complete tables by Fuss are being published in St. Petersburg for the use of the Russian Navy.—EDITOR.

From the right spherical triangle *PBE*, figs. 2 and 3, we have—

(1) $\cos \delta = \cos \alpha \cos \beta$.
(2) $\cot H.A. = \cot \alpha \sin \beta$.

Let α and β be two variables in Cartesian rectangular coordinates. Assign δ a constant value and let α and β vary; then from the first of these equations a certain definite curve will be traced as shown in the diagram (see fig. 4), and by assigning arbitrary values to δ, from 0° up to 90°, a family of declination curves will be obtained. In the same manner there will result a family of hour angle curves (see fig. 5) by assigning arbitrary values to the hour angle *H. A.*, and then letting α and β vary. By constructing the two series of curves on the same set of coordinate axes these results follow.

Thus the plane area is divided into a series of curve line quadrilaterals which may be made as small as we please by tracing the curves at sufficiently small intervals.

If one value of δ and one of *H. A.* be given, then by means of these curves the position of a point is fixed in the plane. The rectangular coordinates of this point are the values of α and β corresponding to these values of δ and *H. A.* Conversely, if we know the values of α and β, we are enabled to plot the position in the plane, and we can read off δ and *H.A.* by means of the curves.

By means of this abacus, the azimuth and altitude of a star may be determined when its declination and hour angle and the estimated colatitude are given. Plot the position of the star by means of δ and *H. A.* curves, estimating the minutes by the eye, and read the rectangular coordinates of the point thus plotted, α on the vertical scale and β on the horizontal scale. The *H. A.* curves here represent meridians and the δ curves represent parallels of the celestial sphere. Now make $B = \lambda + \beta$, considering β negative if the latitude and declination are of contrary name. Plot the point which has α and B for rectangular coordinates, and, considering now the *H. A.* curves to represent verticals, and the δ curves to represent circles of equal latitude, read off the azimuth by means of the *H. A.* curves, and the altitude due to the estimated latitude by means of the δ curves.

This abacus will also serve to find:

(1) The time of rising and setting of a star and its azimuth in the horizon.

(2) The name of an observed star.

(3) The distance and great circle course between two points.

Through the initiative of Monsieur Eugène Pereire, President of the Administrative Council of the Compagnie Générale Transatlantique, this method has been published in rectangular coordinates on four grand-eagle pages on a scale of $\frac{12}{1000}$ of a meter to the degree, and may be purchased in France.

STUDIES ON THE THERMODYNAMICS OF THE ATMOSPHERE.

By Prof. FRANK H. BIGELOW.

I.—ASYMMETRIC CYCLONES AND ANTICYCLONES IN EUROPE AND AMERICA.

INTRODUCTORY REMARKS.

The synthetic construction of the correct statement of the mechanical problems involved in the cyclonic and anticyclonic circulations of the atmosphere depends upon the coordination of the data derived from observations of the velocity vectors, the pressures, and the temperatures prevailing in the moving air masses. In my International Cloud Report, 1898, and in the MONTHLY WEATHER REVIEWS for January, February, and March, 1902, the distribution of the velocity vectors for the United States was described; in the REVIEWS for January and February, 1903, the distribution of the pressures corresponding to these velocities was explained; in this present series of papers the results of my studies on the relation of the temperatures to the velocities and pressures will be summarized. It has been shown conclusively for the United States that there are no true local warm-centered and cold-centered cyclones or anticyclones in the atmosphere, and that all the theoretical discussions or theses founded on that basis are misdirected. The observations demonstrate that in the lower atmosphere the actual mechanism consists of rather deep warm and cold countercurrents of air, which underrun the prevailing eastward drift. The centers of gyration are uniformly in the region where these counterflowing currents meet each other, that is to say, on the edges rather than in the midst of the warm and cold regions. About one half of the cyclone is relatively warm and the other half cold, while the opposite half of the anticyclone is warm and its alternate half is cold. Thus, in the United States, the eastern and northern sectors of the cyclone with the western and northern sectors of the anticyclone are warm, while the western and southern sectors of the cyclone and the eastern and southern sectors of the anticyclone are cold. The warm air flowing from the southwest into the east of the cyclone and west of the anticyclone, and the cold air flowing from the northwest into the east of the anticyclone and the west of the cyclone, constitute two currents whose temperatures differ from each other and from the normal temperature of the prevailing eastward drift. These currents seek to equalize their different temperatures by interpenetration, and in so doing the circulating structures known as cyclonic and anticyclonic are established. The heat added to the tropical zones of the earth by the solar radiation is to a considerable extent transported into the temperate zones by long horizontal currents in the lower levels, and is there expended in generating local circulations. These penetrate the upper current of eastward drift and tend to retard its motion, slowing it down to the moderate velocities which have been found to exist within ten miles of the ground. This stratification and interpenetration of currents of different temperatures is the true source of the energy of storms. The heat energy derived from the condensation of aqueous vapor to water, and the energy produced by purely dynamic eddies are entirely secondary in importance to the thermodynamic energy obtained by the counterflow and underflow of warm southerly currents against the cold northerly currents and beneath the eastward flowing drift. In the present series of papers it is purposed to examine somewhat fully the thermodynamic conditions which exist in the atmosphere, especially in cyclones, anticyclones and tornadoes; at present the temperature data are inadequate for a satisfactory consideration of hurricanes and the general circulation, though something may also be done in that direction.

THE SUPPOSED DIFFERENCE IN THE TEMPERATURE DISTRIBUTION BETWEEN AMERICAN AND EUROPEAN CYCLONES AND ANTICYCLONES.

Certain discussions of the available temperature observations made at different levels in cyclones and anticyclones for the United States and Europe indicate that there is a serious disagreement in the results for the respective regions, as if these local circulations might really be different in some important respects. We should not expect to find any such divergence in the thermodynamics of the atmosphere when the observations and the computations have been accurately made, but as it is comparatively difficult to extract the exact truth of the matter from the actual observations, it will be proper to examine these observations carefully before admitting that any important difference in the structures actually exists. A suitable review of the literature may be found in Mr. Clayton's article,[1] from which the following few statements are compiled:

From a study of mountain observations, Professor Hann found

[1] Various researches on the temperatures in cyclones and anticyclones in temperate latitudes. By H. Helm Clayton. Beiträge zur Physik der freien Atmosphäre. Vol. I, pp. 93-106.

TABLE 1.—*Temperature-falls at Blue Hill.*

HIGH AREAS IN WINTER (OCTOBER TO MARCH).

Height in meters.	North (3).				East (9).				South (10).				West (3).				Mean.	
	F	No.	Δ*T*	*T*	*F*	No.	Δ*T*	*T*	*F*	No.	Δ*T*	*T*	*F*	No.	Δ*T*	*T*	*T*	ΔT/100
	° *F.*		° *F.*	° *C.*	° *F.*		° *F.*	° *C.*	° *F.*		° *F.*	° *C.*	° *F.*		° *F.*	° *C.*	° *C.*	° *C.*
4000	....	..	−21.2	− 7.9	....	..	−37.4	−18.8	....	..	−31.0	−17.9	....	..	−29.8	− 7.6	−13.1	−0.50
3800	−10.5	1	−19.8	− 7.3	−36.1	2	−35.2	−17.5	....	..	−28.9	−16.8	....	..	−28.0	− 6.6	−12.1	−0.55
3600	−18.7	3	−18.2	− 6.4	−32.0	2	−33.2	−16.3	....	..	−27.0	−15.7	....	..	−26.6	− 5.8	−11.1	−0.50
3400	−17.5	2	−16.8	− 5.6	−32.8	3	−30.9	−15.1	−20.5	1	−25.0	−14.6	....	..	−25.2	− 5.0	−10.1	−0.50
3200	−13.9	2	−15.2	− 4.7	−27.9	4	−28.7	−14.0	−20.6	1	−23.1	−13.6	....	..	−23.8	− 4.2	− 9.1	−0.50
3000	−13.7	2	−13.7	− 3.9	−32.1	5	−26.5	−12.7	−17.8	2	−21.3	−12.6	....	..	−21.8	− 3.1	− 8.1	−0.45
2800	−12.5	3	−12.2	− 3.1	−23.6	8	−24.5	−11.6	−19.2	3	−19.8	−11.7	....	..	−20.5	− 2.4	− 7.2	−0.40
2600	−10.2	3	−11.0	− 2.4	−15.0	5	−22.3	−10.4	....	..	−18.4	−10.9	−12.7	1	−19.0	− 1.6	− 6.4	−0.40
2400	−10.1	3	−10.2	− 2.0	−20.8	1	−20.4	− 9.3	....	..	−16.7	−10.0	−17.7	1	−17.7	− 0.9	− 5.6	−0.40
2200	− 6.4	1	− 9.4	− 1.5	−16.3	6	−18.5	− 8.3	−17.4	1	−15.8	− 9.4	−13.2	2	−16.1	0.0	− 4.8	−0.45
2000	− 6.9	5	− 8.8	− 1.2	−18.3	7	−16.5	− 7.1	+ 6.5	1	−13.7	− 8.3	....	..	−14.4	1,0	− 3.9	−0.60
1800	− 9.2	4	− 6.0	0.4	−12.5	6	−14.7	− 6.2	....	..	−11.6	− 7.2	−17.6	1	−12.4	2.1	− 2.7	−0.60
1600	− 8.2	4	− 4.2	1.4	−16.8	4	−12.6	− 5.0	+ 2.3	6	− 9.4	− 5.9	−12.0	2	−10.4	3.4	− 1.5	−0.40
1400	+ 0.2	1	− 3.0	2.0	−10.9	13	−11.3	− 4.3	− 4.5	8	− 6.8	− 4.5	− 8.5	3	− 9.2	3.9	− 0.7	−0.20
1200	− 5.7	3	− 2.6	2.1	−12.0	8	−10.4	− 3.8	− 5.8	6	− 5.3	− 3.7	− 7.4	7	− 8.6	4.2	− 0.3	−0.05
1000	+ 0.8	2	− 3.5	1.8	− 8.0	11	− 9.8	− 3.5	− 2.6	8	− 5.2	− 3.6	− 7.6	5	− 8.2	4.5	− 0.2	−0.15
800	− 3.1	4	− 4.6	1.1	− 5.0	13	− 8.7	− 2.8	− 6.6	13	− 5.8	− 3.9	− 9.5	7	− 7.2	5.0	0.1	−0.10
600	− 7.9	1	− 4.4	1.3	− 9.3	15	− 6.8	− 1.8	− 7.8	17	− 6.0	− 4.0	− 6.4	6	− 6.0	5.7	0.3	−0.45
400	− 3.7	4	− 3.6	1.7	− 4.1	16	− 4.3	− 0.4	− 5.0	16	− 5.2	− 3.6	− 3.3	1	− 3.7	7.0	1.2	−0.55
200	− 1.3	50	− 1.8	2.7	− 1.4	151	− 2.0	0.9	− 2.5	107	− 3.2	− 2.5	− 2.1	36	− 2.0	7.9	2.3	−0.60
0	38.7	50	38.7	3.7	35.6	151	35.6	2.0	30.7	107	30.7	− 0.7	48.2	36	48.2	9.0	3.5	....
																		Mean −0.42

LOW AREAS IN WINTER.

Height in meters.	North (0).				East (5).				South (13).				West (7).				Mean.	
	F	No.	Δ*T*	*T*	*F*	No.	Δ*T*	*T*	*F*	No.	Δ*T*	*T*	*F*	No.	Δ*T*	*T*	*T*	ΔT/100
	° *F.*		° *F.*	° *C.*	° *F.*		° *F.*	° *C.*	° *F.*		° *F.*	° *C.*	° *F.*		° *F.*	° *C.*	° *C.*	° *C.*
4000	....	..	....	....	....	..	−28.7	−13.2	....	..	−45.0	−18.7	....	..	−24.0	−16.0	−16.0	−0.55
3800	....	..	....	....	....	..	−26.7	−12.0	....	..	−43.0	−17.6	....	..	−22.4	−15.1	−14.9	−0.45
3600	....	..	....	....	....	..	−25.2	−11.2	....	..	−40.8	−16.4	....	..	−20.9	−14.3	−14.0	−0.50
3400	....	..	....	....	....	..	−23.4	−10.2	....	..	−38.7	−15.2	....	..	−19.4	−13.5	−13.0	−0.55
3200	....	..	....	....	....	..	−21.4	− 9.1	−37.9	2	−36.4	−13.9	....	..	−18.0	−12.7	−11.9	−0.55
3000	....	..	....	....	....	..	−19.7	− 8.1	−35.2	2	−34.0	−12.6	− 4.9	1	−16.0	−11.6	−10.8	−0.55
2800	....	..	....	....	....	..	−17.8	− 7.1	−31.1	2	−32.0	−11.5	− 3.2	3	−14.2	−10.6	− 9.7	−0.50
2600	....	..	....	....	....	..	−15.8	− 6.0	−30.1	3	−29.6	−10.2	+ 1.1	3	−12.8	− 9.8	− 8.7	−0.60
2400	....	..	....	....	....	..	−14.0	− 5.0	−26.5	4	−27.0	− 8.7	+ 3.5	2	−11.2	− 8.9	− 7.5	−0.45
2200	....	..	....	....	−10.9	3	−12.0	− 3.9	−23.3	6	−24.8	− 7.5	− 9.6	4	−10.0	− 8.3	− 6.6	−0.45
2000	....	..	....	....	− 8.3	6	−10.3	− 3.0	−23.9	6	−22.7	− 6.3	− 4.5	5	− 9.2	− 7.8	− 5.7	−0.40
1800	....	..	....	....	− 6.5	3	− 9.2	− 2.3	−20.2	5	−20.3	− 5.0	−10.7	7	− 8.5	− 7.4	− 4.9	−0.20
1600	....	..	....	....	−10.7	3	− 9.3	− 2.4	−18.0	20	−18.0	− 3.7	− 9.5	5	− 8.4	− 7.3	− 4.5	−0.15
1400	....	..	....	....	− 8.6	7	− 9.8	− 2.7	−15.7	23	−16.0	− 2.6	− 7.2	7	− 8.4	− 7.3	− 4.2	−0.25
1200	....	..	....	....	−10.2	8	−10.0	− 2.8	−14.0	31	−13.8	− 1.4	− 8.2	8	− 7.9	− 7.0	− 3.7	−0.25
1000	....	..	....	....	−10.0	5	− 9.8	− 2.7	−10.3	22	−11.4	− 0.1	− 9.6	8	− 7.3	− 6.8	− 3.2	−0.40
800	....	..	....	....	−11.1	4	− 8.9	− 2.2	− 8.2	17	− 9.2	1.2	− 4.8	7	− 6.1	− 6.1	− 2.4	−0.40
600	....	..	....	....	− 6.5	8	− 7.5	− 1.4	− 8.0	21	− 7.3	2.2	− 5.5	11	− 5.0	− 5.5	− 1.6	−0.55
400	....	..	....	....	− 5.7	8	− 5.9	− 0.5	− 4.1	13	− 4.7	3.7	− 4.0	13	− 3.7	− 4.7	− 0.5	−0.65
200	....	..	....	....	− 2.2	62	− 3.0	1.1	− 1.6	185	− 2.4	5.0	− 1.9	109	− 2.0	− 3.8	0.8	−0.65
0	....	..	....	....	37.1	62	37.1	2.8	43.4	185	43.3	6.3	27.1	123	27.1	− 2.7	2.1	....
																		Mean −0.43

that in the higher levels the temperature is relatively low over cyclones, but high over anticyclones, and thence he supposed that this apparent inversion must be due to dynamic actions, as of eddies or driven whirls in the prevailing eastward drift. To somewhat the same effect the investigations of Dechevrens, Berson, and Teisserenc de Bort have come, namely, that "cyclones average colder than anticyclones below nine kilometers." On the other hand, the investigations of Harrington, Rotch, Hazen, Clayton, Shaw, and Dines lead to the conclusion that "cyclones average warmer than anticyclones."

The discussion of the temperatures over Hald and Berlin by Grenander[2] is said to support Hann's proposition rather than the American view. It is worth while to find whether this contradiction can be readily reconciled. Without examining critically the observations themselves and the methods of reduction that have been employed, it is sufficient to remark that a very large number of observations is required to arrive at definitive results, and that both the annual and the diurnal variations of temperature must be eliminated from the temperature-falls from the surface. Mountain observations require a series of local corrections to be applied to reduce them to free air measures of temperature, and, generally, the observations must be distributed quite uniformly throughout the 24 hours. The tendency is to use an excess of daytime observations, and this will produce one-sided data in the strata up to at least the elevation of 3000 meters. In the following exposition it will be sufficient to employ the data contained in Grenander's paper and in the Blue Hill paper,[3] which have already been used in my discussion of the diurnal periods of the temperature. We shall expect to show that the structures of the American and European cyclones and anticyclones are practically the same, except possibly in the lower strata, within 2000 meters of the surface.

THE TEMPERATURE-FALLS AT BLUE HILL AND HALD-BERLIN.

The reader is referred to my paper on "The diurnal periods of the temperature"[4] for a description of the method employed in discussing the Blue Hill kite observations of 1897–1902.

[2] Les gradients verticaux de la température dans les minima et les maxima barométriques. Par S. Grenander. Arkiv för matematik, astronomi och fysik. Bd. 2, No. 7. (1905.)

[3] Observations at the Blue Hill Observatory, 1901–2, and appendix of the observations with kites, 1897–1902, with discussion by H. Helm Clayton.

[4] Monthly Weather Review, February, 1905.

TABLE 2.—*Temperature-falls at Blue Hill.*

HIGH AREAS IN SUMMER (APRIL TO SEPTEMBER).

Height in meters.	Center (1).				East (24).				South (12).				West (8).				Mean.	
	F	No.	ΔT	T	F	No.	ΔT	T	F	No.	ΔT	T	F	No.	ΔT	T	T	ΔT/100
	° F.		° F.	° C.	° F.		° F.	° C.	° F.		° F.	° C.	° F.		° F.	° C.	° C.	° C.
4000	......	...	−37.4	−2.9	−48.3	1	−45.2	−8.4	......	...	−43.3	−9.6	......	...	−41.2	−4.8	−6.4	−0.80
3800	−38.9	2	−35.0	−1.5	−40.0	1	−42.1	−6.7	.....	...	−40.0	−7.7	−35.0	1	−38.7	−3.4	−4.8	−0.75
3600	−30.8	2	−32.6	−0.2	−45.2	1	−39.1	−5.1	......	...	−36.7	−5.9	−35.2	1	−36.2	−2.0	−3.3	−0.75
3400	−31.8	4	−30.2	1.1	−33.2	1	−36.0	−3.3	−33.0	1	−33.5	−4.1	−32.8	2	−33.8	−0.7	−1.8	−0.75
3200	−27.2	2	−28.2	2.3	......	...	−33.0	−1.6	−30.7	2	−30.2	−2.3	−31.7	2	−31.5	0.6	−0.3	−0.70
3000	−27.7	5	−25.4	3.6	−32.6	7	−29.8	0.1	−26.1	1	−27.2	−0.6	......	. .	−29.0	2.0	1.1	−0.75
2800	−22.2	6	−23.3	4.9	−22.6	10	−27.3	1.5	−28.0	1	−24.6	0.8	......	...	−26.6	3.3	2.6	−0.70
2600	−21.6	6	−21.2	6.1	−22.1	5	−24.5	3.1	−17.1	1	−22.0	2.3	−32.5	3	−24.4	4.6	4.0	−0.60
2400	−17.0	6	−19.4	7.1	−17.5	6	−22.2	4.4	−15.5	2	−20.0	3.4	−29.1	5	−22.2	5.8	5.2	−0.60
2200	−16.0	5	−17.3	8.3	−20.7	9	−19.9	5.7	− 7.7	3	−18.0	4.5	−22.0	7	−20.0	7.0	6.4	−0.60
2000	−18.2	5	−15.4	9.4	−18.0	9	−17.4	7.1	−12.7	5	−15.9	5.8	−18.6	8	−18.0	8.1	7.6	−0.60
1800	−14.9	11	−13.6	10.2	−18.7	15	−15.2	8.3	−15.2	6	−13.5	7.0	−17.4	7	−16.0	9.2	8.7	−0.55
1600	−11.4	8	−11.8	11.3	−15.3	16	−12.6	9.7	−16.1	7	−11.2	8.3	−14.3	8	−14.6	10.0	9.8	−0.55
1400	−10.2	11	−10.0	12.3	−11.4	20	−10.2	11.0	− 7.6	15	− 9.1	9.4	−17.8	8	−13.5	10.6	10.8	−0.50
1200	− 7.1	13	− 8.5	13.2	− 8.3	28	− 7.4	12.5	− 6.8	10	− 7.2	10.5	−16.8	9	−12.0	11.4	11.9	−0.30
1000	− 7.1	16	− 7.9	13.6	− 4.7	35	− 6.7	13.0	− 5.7	17	− 6.0	11.2	−13.2	11	−10.7	12.1	12.5	−0.20
800	− 7.9	17	− 7.6	13.7	− 2.2	38	− 6.0	13.4	− 4.8	14	− 5.3	11.5	− 7.3	13	− 9.2	13.0	12.9	−0.30
600	− 1.9	24	− 6.1	14.5	+ 2.6	46	− 4.7	14.1	− 5.4	19	− 5.2	11.6	− 7.9	18	− 7.8	13.8	13.5	−0.45
400	− 4.3	25	− 4.3	15.5	− 1.9	46	− 2.5	15.3	− 5.3	19	− 4.6	11.9	− 8.4	10	− 6.2	14.7	14.4	−0.60
200	− 1.1	178	− 2.0	16.8	− 0.9	326	− 0.6	16.3	− 2.6	134	− 2.8	12.9	− 2.9	119	− 2.7	16.6	15.7	−0.55
0	64.3	178	64.3	17.9	62.0	326	62.0	16.7	58.1	134	58.1	14.5	64.6	119	64.6	18.1	16.8	......
																	Mean	−0.62

LOW AREAS IN SUMMER.

Height in meters.	Center (4).				East (5).				South (22).				West (7).				Mean.	
	F	No.	ΔT	T	F	No.	ΔT	T	F	No.	ΔT	T	F	No.	ΔT	T	T	ΔT/100
	° F.		° F.	° C.	° F.		° F.	° C.	° F.		° F.	° C.	° F.		° F.	° C.	° C.	° C.
4000	......	...	−44.0	−9.8	......	...	−38.8	−6.0	......	...	−48.2	−3.6	......	...	−46.5	−9.0	−7.1	−0.60
3800	......	...	−42.3	−8.9	......	...	−36.4	−4.6	......	...	−45.0	−2.1	......	...	−44.8	−8.0	−5.9	−0.55
3600	−41.8	1	−40.4	−7.8	−38.8	2	−34.6	−3.6	−35.6	1	−43.2	−0.8	−41.5	1	−43.0	−6.0	−4.8	−0.60
3400	......	...	−38.8	−7.0	−31.3	1	−32.2	−2.3	−37.9	5	−41.0	0.4	−38.8	2	−40.7	−5.7	−3.6	−0.55
3200	−37.3	1	−37.0	−6.0	−33.3	2	−30.5	−1.4	−42.0	6	−38.8	1.6	−35.5	4	−38.4	−4.4	−2.5	−0.60
3000	−35.5	3	−35.0	−4.8	−31.8	3	−28.6	−0.3	−31.9	13	−36.1	3.1	−39.0	3	−36.4	−3.3	−1.3	−0.50
2800	−33.2	3	−33.2	−3.8	−35.5	4	−26.8	0.7	−35.2	11	−34.6	4.0	−28.6	6	−34.0	−2.0	−0.3	−0.60
2600	−28.9	4	−31.0	−2.6	−29.1	2	−24.8	1.8	−30.9	14	−32.7	5.1	−26.3	4	−31.5	−0.6	0.9	−0.60
2400	−29.7	6	−28.6	−1.3	−25.4	2	−23.2	2.7	−31.2	17	−30.4	6.3	−24.7	9	−29.6	0.5	2.1	−0.65
2200	−26.8	7	−26.0	0.2	−21.5	3	−21.0	3.9	−28.8	18	−28.2	7.5	−23.0	12	−27.2	1.8	3.4	−0.60
2000	−23.7	7	−23.5	1.6	−15.3	4	−19.4	4.8	−25.9	18	−25.8	8.9	−26.7	9	−25.0	3.0	4.6	−0.68
1800	−25.3	3	−20.7	3.1	−15.4	4	−17.0	6.2	−24.0	23	−23.4	10.2	−25.9	12	−23.2	4.0	5.9	−0.65
1600	−16.0	3	−18.0	4.6	−14.9	5	−15.1	7.2	−20.4	18	−20.8	11.6	−20.6	9	−20.8	5.3	7.2	−0.65
1400	−14.1	6	−15.7	5.9	−17.6	5	−13.3	8.2	−18.2	25	−18.1	13.1	−20.3	12	−18.2	6.8	8.5	−0.60
1200	−13.6	5	−13.2	7.3	−11.1	6	−11.6	9.1	−16.7	22	−15.6	14.5	−18.8	11	−16.0	8.0	9.7	−0.55
1000	−12.1	6	−11.0	8.5	− 5.5	3	− 9.7	10.2	−14.2	25	−13.0	16.0	−13.7	12	−14.6	8.8	10.8	−0.65
800	− 9.7	3	− 9.2	9.5	−10.1	8	− 7.8	11.3	−11.0	33	−10.5	17.3	−12.9	10	−12.0	10.2	12.1	−0.75
600	− 7.4	5	− 6.8	10.8	− 5.7	8	− 5.7	12.5	− 8.9	38	− 8.0	18.8	− 5.9	12	− 7.8	12.3	13.6	−0.80
400	− 3.4	8	− 4.3	12.2	− 5.8	11	− 3.5	13.6	− 5.5	40	− 5.3	20.2	− 3.0	11	− 4.0	14.7	15.2	−0.60
200	− 3.4	73	− 2.0	13.5	− 2.7	82	− 1.6	14.7	− 2.7	341	− 2.7	21.7	− 1.6	138	− 2.0	15.8	16.4	−0.60
0	58.2	73	58.2	14.6	60.1	82	60.1	15.6	73.7	341	73.7	23.2	62.5	145	62.5	16.9	17.6	......
																	Mean	−0.63

It is convenient to utilize the same data for discussing the distribution of temperature in the several strata of cyclones and anticyclones up to the height of about 4000 meters, for the sake of eliminating the diurnal variation. This was done by taking the mean values of the temperatures as observed at the several ascensions, which were distributed in the different hours of the day. While the distribution among the 24 hours is not completely uniform, it is probable that a fairly satisfactory elimination of the diurnal temperature varition in the levels from the surface to 3000 meters has been accomplished in my computations, by taking the average daily values as they exist in this report for the winter months (October to March) and the summer months (April to September), thus making two groups for the five years of observations. The number of available observations is not nearly great enough to give definitive mean values, but the results here explained probably indicate quite sufficiently the typical conditions that require to be known as the basis of a theoretical discussion of the thermodynamics of storms.

Table 1, temperature-falls at Blue Hill, winter high areas and low areas, and Table 2, summer high areas and low areas, summarize the data. The temperature-falls are given for the N. E. S. W. sectors, and for the center when possible. These sectors group the data according to my subareas as follows: For center we take subareas (1, 2, 3, 4), for north (9, 10, 17, 18), east (7, 8, 15, 16), south (5, 6, 13, 14), west (11, 12, 19, 20). The areas at the time of observation at Blue Hill were located in respect to these subareas by studying the corresponding weather maps and selecting the most conspicuous high area or low area for the center.

EXPLANATION OF TABLES 1, 2, 3, AND 4.

The first column of Table 1 gives the height in meters, the second, F, the mean temperature-falls in Fahrenheit degrees, as determined by the number of observations recorded in column three; these temperature-falls were plotted on diagrams and average curves were drawn through the points, from which the values of ΔT found in column four were scaled, and these should represent more exact values than can be obtained from the limited number of observations at our disposal. At the bottom of columns F and ΔT is found the mean surface temperature, determined by the numerous readings made at the Blue Hill valley station. In column five, marked T, are given the corresponding temperatures themselves in centigrade degrees, being transformed from the Fahrenheit degrees re-

TABLE 3.—*Temperature-falls at Hald and Berlin.*

HIGH AREAS IN WINTER (OCTOBER TO MAY 15).

Height in meters.	North.		East.		South.		West.		Mean.	
	ΔT	T	ΔT	T	ΔT	T	ΔT	T	T	$\frac{\Delta T}{100}$
	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.
6000	-31.6	-27.0	-34.0	-33.2	-25.3	-24.5	-25.7	-21.6	-26.6	-0.75
5800	-30.0	-25.4	-32.5	-31.7	-23.9	-23.1	-24.4	-20.3	-25.1	-0.70
5600	-28.3	-23.7	-31.0	-30.2	-22.7	-21.9	-22.9	-18.8	-23.7	-0.80
5400	-26.7	-22.1	-28.7	-27.9	-21.7	-20.9	-21.4	-17.3	-22.1	-0.80
5200	-25.5	-20.9	-26.7	-25.9	-20.3	-19.5	-19.8	-15.7	-20.5	-0.70
5000	-24.2	-19.6	-24.8	-24.0	-19.1	-18.3	-18.6	-14.5	-19.1	-0.60
4800	-22.8	-18.2	-23.6	-22.8	-18.1	-17.3	-17.5	-13.4	-17.9	-0.55
4600	-21.6	-17.0	-22.4	-21.6	-17.1	-16.3	-16.3	-12.2	-16.8	-0.75
4400	-19.8	-15.2	-21.0	-20.2	-45.7	-14.9	-15.0	-10.9	-15.3	-0.65
4200	-18.6	-14.0	-20.0	-19.2	-14.7	-13.9	-14.0	- 9.9	-14.0	-0.45
4000	-17.5	-12.9	-18.8	-18.0	-13.7	-12.9	-12.6	- 8.5	-13.1	-0.50
3800	-16.4	-11.8	-18.0	-17.2	-12.8	-12.0	-11.6	- 7.5	-12.1	-0.45
3600	-15.4	-10.8	-17.2	-16.4	-11.9	-11.1	-10.6	- 6.5	-11.2	-0.50
3400	-14.3	- 9.7	-16.4	-15.6	-10.9	-10.1	- 9.5	- 5.4	-10.2	-0.55
3200	-13.2	- 8.6	-15.1	-14.3	- 9.8	- 9.0	- 8.6	- 4.5	- 9.1	-0.55
3000	-12.2	- 7.6	-14.0	-13.2	- 8.7	- 7.9	- 7.4	- 3.3	- 8.0	-0.40
2800	-11.2	- 6.6	-13.1	-12.3	- 8.4	- 7.6	- 6.9	- 2.8	- 7.2	-0.40
2600	-10.3	- 5.7	-12.3	-11.5	- 7.8	- 7.0	- 6.3	- 2.2	- 6.6	-0.40
2400	- 9.4	- 4.8	-11.4	-10.6	- 7.2	- 6.4	[illegible]	- 1.3	- 5.8	-0.45
2200	- 8.1	- 3.5	-10.7	- 9.9	- 6.7	- 5.9	- 4.4	- 0.3	- 4.9	-0.40
2000	- 7.1	- 2.5	- 9.8	- 9.0	- 6.2	- 5.4	- 3.6	0.5	- 4.1	-0.35
1800	- 6.5	- 1.9	- 8.8	- 8.0	- 5.5	- 4.7	- 2.9	1.2	- 3.4	-0.35
1600	- 6.0	- 1.4	- 7.9	- 7.1	- 4.9	- 4.1	- 2.3	1.8	- 2.7	-0.35
1400	- 5.3	- 0.7	- 6.8	- 6.0	- 4.3	- 3.5	- 1.9	2.2	- 2.0	-0.30
1200	- 4.6	0.0	- 5.6	- 4.8	- 3.9	- 3.1	- 1.6	2.5	- 1.4	-0.30
1000	- 4.0	0.6	- 4.6	- 3.8	- 3.4	- 2.6	- 1.3	2.8	- 0.8	-0.40
800	- 3.2	1.4	- 3.4	- 2.6	- 2.8	- 2.0	- 0.9	3.2	0.0	-0.35
600	- 2.4	2.2	- 2.2	- 1.4	- 2.3	- 1.5	- 0.6	3.5	0.7	-0.35
400	- 1.5	3.1	- 1.2	- 0.4	- 1.7	- 0.9	- 0.4	3.7	1.4	-0.30
200	- 0.7	3.9	- 0.5	0.3	- 0.8	0.0	- 0.2	3.9	2.0	-0.30
0	0.0	4.6	0.0	0.8	0.0	0.8	0.0	4.1	2.6	......
					Mean gradient up to 4000 meters......					-0.40

LOW AREAS IN WINTER.

Height in meters.	North.		East.		South.		West.		Mean.	
	ΔT	T	ΔT	T	ΔT	T	ΔT	T	T	$\frac{\Delta T}{100}$
	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.
6000	-33.4	-26.5	-33.8	-29.6	-34.4	-27.8	-35.5	-29.0	-28.2	-0.75
5800	-31.7	-24.8	-32.4	-28.2	-33.2	-26.6	-34.0	-27.5	-26.7	-0.70
5600	-29.8	-22.9	-31.0	-26.8	-32.0	-25.4	-32.8	-26.3	-25.3	-0.65
5400	-28.2	-21.3	-29.7	-25.5	-30.8	-24.2	-31.8	-25.3	-24.0	-0.65
5200	-27.0	-20.1	-28.0	-23.8	-29.2	-22.6	-31.0	-24.5	-22.7	-0.50
5000	-26.1	-19.2	-26.6	-22.4	-28.3	-21.7	-30.3	-23.8	-21.7	-0.50
4800	-24.8	-17.9	-25.7	-21.5	-26.9	-20.3	-29.6	-23.1	-20.7	-0.55
4600	-23.8	-16.9	-24.3	-20.1	-25.8	-19.2	-28.8	-22.3	-19.6	-0.65
4400	-22.5	-15.6	-23.0	-18.8	-24.2	-17.6	-28.0	-21.5	-18.3	-0.65
4200	-21.1	-14.2	-21.4	-17.2	-22.8	-16.2	-26.9	-20.4	-17.0	-0.55
4000	-19.9	-13.0	-20.2	-16.0	-22.0	-15.4	-26.0	-19.5	-15.9	-0.55
3800	-18.7	-11.8	-19.0	-14.8	-21.0	-14.4	-24.7	-18.2	-14.8	-0.60
3600	-17.4	-10.5	-17.9	-13.7	-20.0	-13.4	-23.4	-16.9	-13.6	-0.65
3400	-16.0	- 9.1	-16.5	-12.3	-18.8	-12.2	-22.2	-15.7	-12.3	-0.60
3200	-14.7	- 7.8	-15.2	-11.0	-17.7	-11.1	-21.0	-14.5	-11.1	-0.55
3000	-13.5	- 6.6	-14.2	-10.0	-16.6	-10.0	-19.7	-13.2	-10.0	-0.65
2800	-12.5	- 5.6	-13.4	- 9.2	-15.4	- 8.8	-17.8	-11.3	- 8.7	-0.65
2600	-11.3	- 4.4	-12.6	- 8.4	-14.2	- 7.6	-15.9	- 9.4	- 7.4	-0.55
2400	-10.5	- 3.6	-11.3	- 7.1	-13.0	- 6.4	-14.6	- 8.1	- 6.3	-0.60
2200	- 9.8	- 2.9	-10.2	- 6.0	-11.8	- 5.2	-13.1	- 6.6	- 5.1	-0.55
2000	- 8.4	- 1.5	- 9.2	- 5.0	-10.8	- 4.2	-12.0	- 5.5	- 4.0	-0.45
1800	- 7.8	- 0.9	- 8.0	- 3.8	- 9.8	- 3.2	-11.0	- 4.5	- 3.1	-0.55
1600	- 6.6	0.3	- 7.0	- 2.8	- 8.8	- 2.2	-10.0	- 3.5	- 2.0	-0.50
1400	- 5.8	1.1	- 5.9	- 1.7	- 7.7	- 1.1	- 8.8	- 2.3	- 1.0	-0.60
1200	- 5.4	1.5	- 4.7	- 0.5	- 6.4	0.2	- 7.3	- 0.8	0.2	-0.55
1000	- 4.8	2.1	- 3.2	1.0	- 5.2	1.4	- 6.0	0.5	1.3	-0.50
800	- 3.6	3.3	- 2.6	1.6	- 4.2	2.4	- 4.7	1.8	2.3	-0.50
600	- 2.4	4.5	- 1.8	2.4	- 3.1	3.5	- 3.8	2.7	3.3	-0.55
400	- 1.3	5.6	- 1.1	3.1	- 2.1	4.5	- 2.3	4.2	4.4	-0.50
200	- 0.6	6.3	- 0.5	3.7	- 0.7	5.9	- 0.9	5.6	5.4	-0.35
0	0.0	6.9	0.0	4.2	0.0	6.6	0.0	6.5	6.1	......
					Mean gradient up to 4000 meters......					-0.55

corded in column four, and the temperature for each stratum is computed by adding the temperature-falls ΔT, as reduced to centigrade degrees, to the surface temperature T. At the head of each section group is given the number of ascensions employed, as 3 for north, 9 for east, 10 for south, etc. In the last columns of each general group are given the mean temperatures of the sectors on the several levels, and the mean gradients per 100 meters. The gradients in the several sectors can be readily computed from the temperatures recorded for every 200-meter level up to 4000 meters. It should be noted that the data are entirely lacking for the north sector, except for the winter high areas, where three ascensions were available, and that observations in the central area are found only for the summer half of the year. This failure to record the temperature in the north sector is due to two causes, (1) the general passage of the centers of pressure to the north of Blue Hill, and (2), especially, the class of winds prevailing in that sector, which are usually unfavorable for kite ascensions.

For the European cyclones and anticyclones I have employed the data found in Grenander's paper. The temperature-falls in winter low and high areas at Hald and Berlin (Table 3) were taken from the tables and diagram without change. For these the results are recorded in Tables 3 and 4, where ΔT is the temperature-fall from the surface and T the corresponding temperature at every 200-meter level. In order to eliminate the diurnal variation from the surface mean temperatures, upon which every thing depends, it was necessary to interpolate a few of the missing night temperatures as in Table 5.

There is, of course, some uncertainty in this connection, but not nearly enough to modify the conclusions based upon these surface means. It is much better to obtain approximate mean temperatures for the 24 hours than to employ those belonging exclusively to the day hours. In the summer months the Hald and the Berlin temperatures were treated separately (see Table 4) and the adopted temperatures are the mean values of the two stations in the several 200-meter levels. The column T is the mean of the Hald and Berlin columns, with interpolations, and ΔT is computed from T.

TEMPERATURE-FALLS FROM THE SURFACE.

There are two ways in which the data of these tables can be conveniently arranged for discussion, (1) by exhibiting the temperature-falls on a diagram, and (2) by constructing the temperatures prevailing in the horizontal sections at different elevations. Fig. 1 represents the American and European temperature-falls in high and low areas, in winter and summer. It shows at a glance that the high areas (full lines) are not all cold as compared with the low areas, nor the low areas (dotted lines) all warm as compared with the high areas. On the other hand the north and west of the high areas are warm, while the south and east are cold, both winter and summer. In the lower levels, 1000 to 2000 meters, there is some entanglement of the gradient lines, and while there may be a tendency for the dotted lines of the low areas to cross the full lines of the high areas from right to left, there is nothing very decisive about the relation. In the American areas the temperatures of the high areas generally have a small gradient in the levels 1000 to 2000 meters, and there is, also, some indication of the same tendency in the European high areas. Attention is directed to chart 14, International Cloud Report, 1898, where a corresponding vertical change in the velocities was recorded, indicating that this stratum has a steady velocity throughout its depth in accordance with this local temperature distribution. In the winter both the European and American temperatures have about the same extreme differences, approximately 10° C. above the 2000-meter level, though below it the American exceed the European by about 4° C. The American circulation near the surface in winter is usually more active than the European. In the summer the American temperature divergence seems to be rather less, about 2°, than the European, though this difference may really be due to an inadequacy in the results of the observations in hand, and may be changed by increasing their number. On the whole there are indications that the temperature spread is wider at the 3000-meter level than at any height above or below, and this implies that the local circulation is greater at this level

Fig. 1.—American and European Temperature-falls, ΔT, in High and Low Areas, in Winter and Summer.

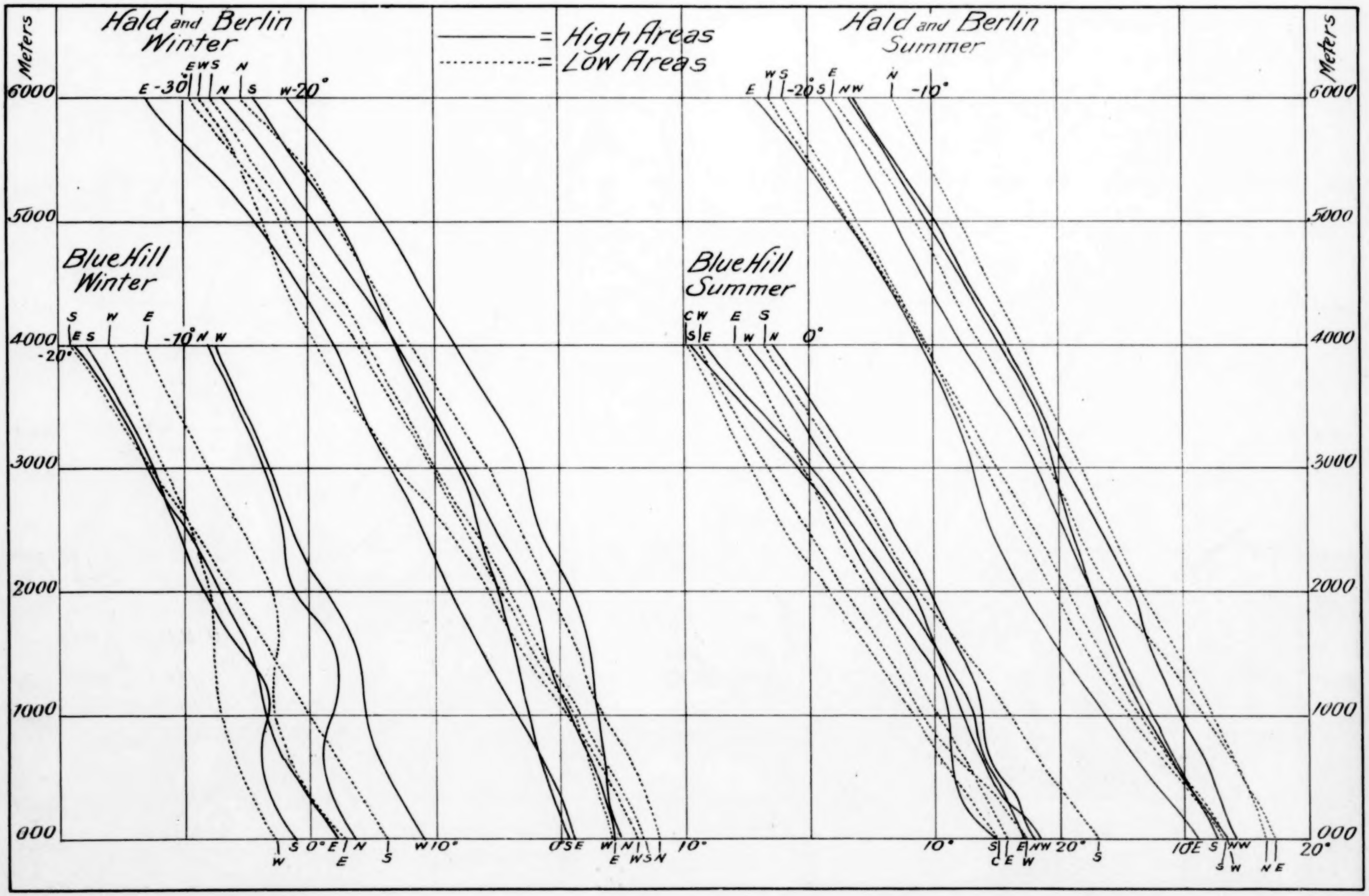

Fig. 2.—American and European Temperature-falls, ΔT, in Warm and Cold Areas, in Winter and Summer.

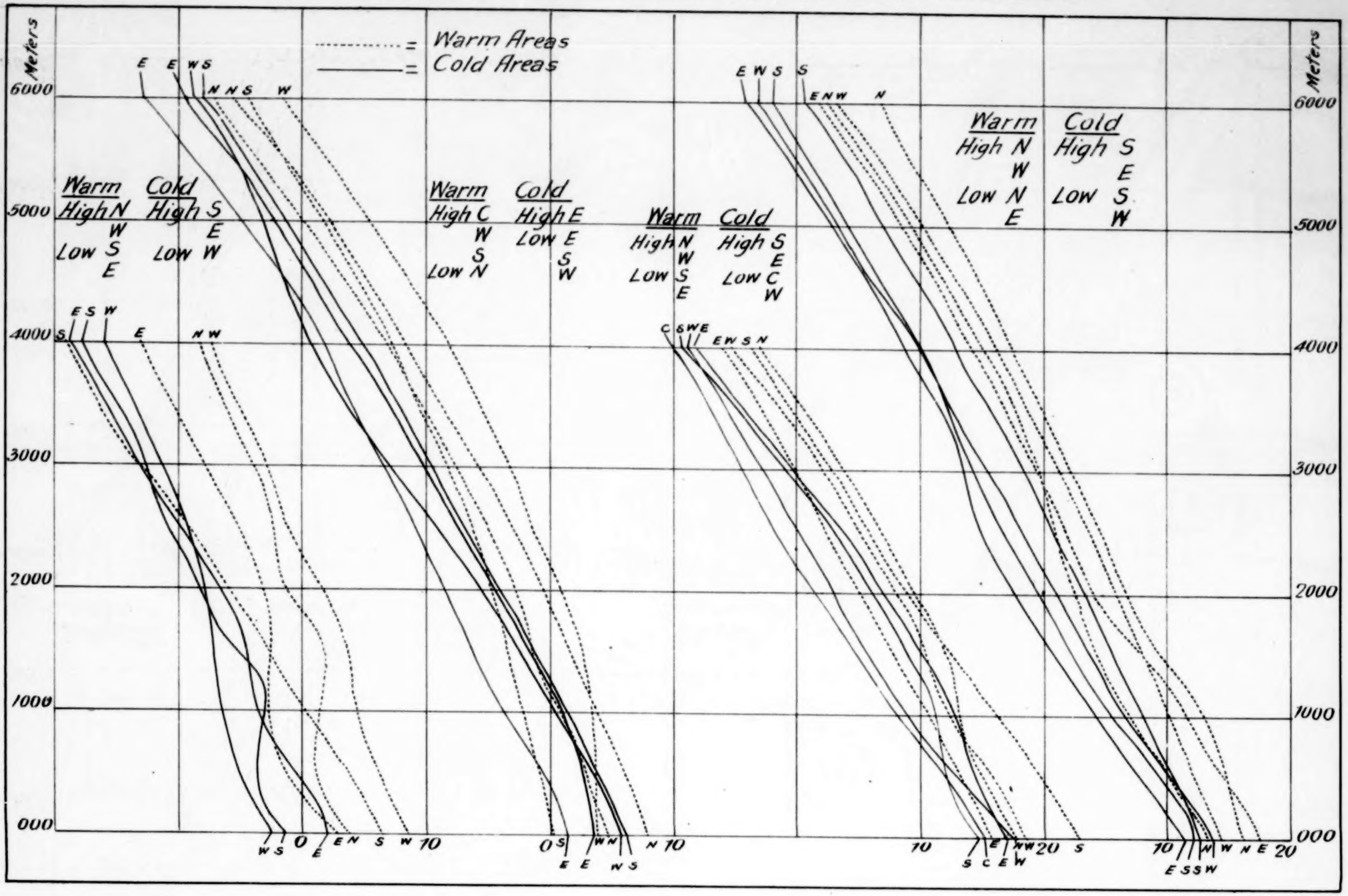

FIG. 3.—The Distribution of Temperature in the High and Low Pressure Areas of North America.

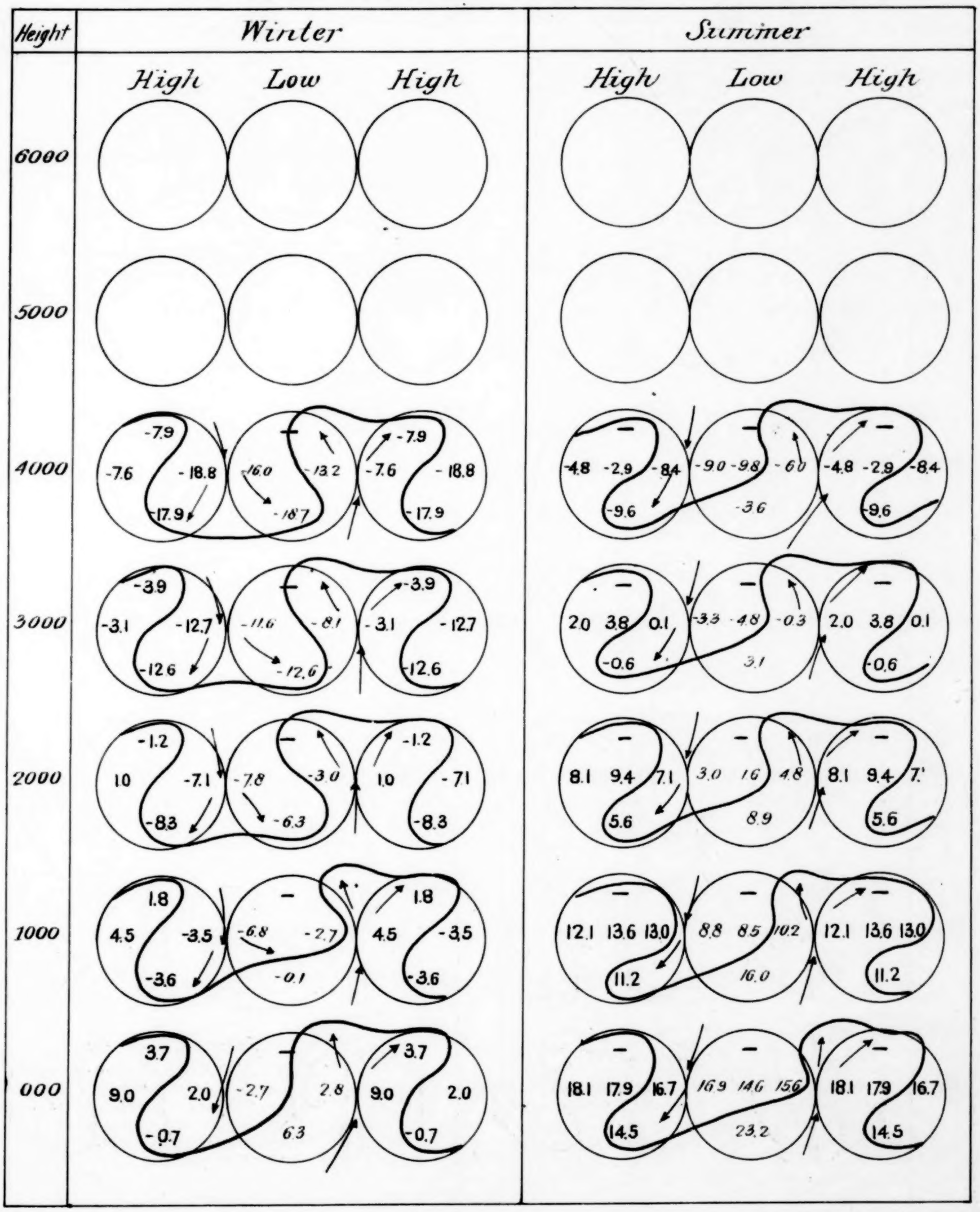

Fig. 4.—The Distribution of Temperature in the High and Low Pressure Areas of Europe.

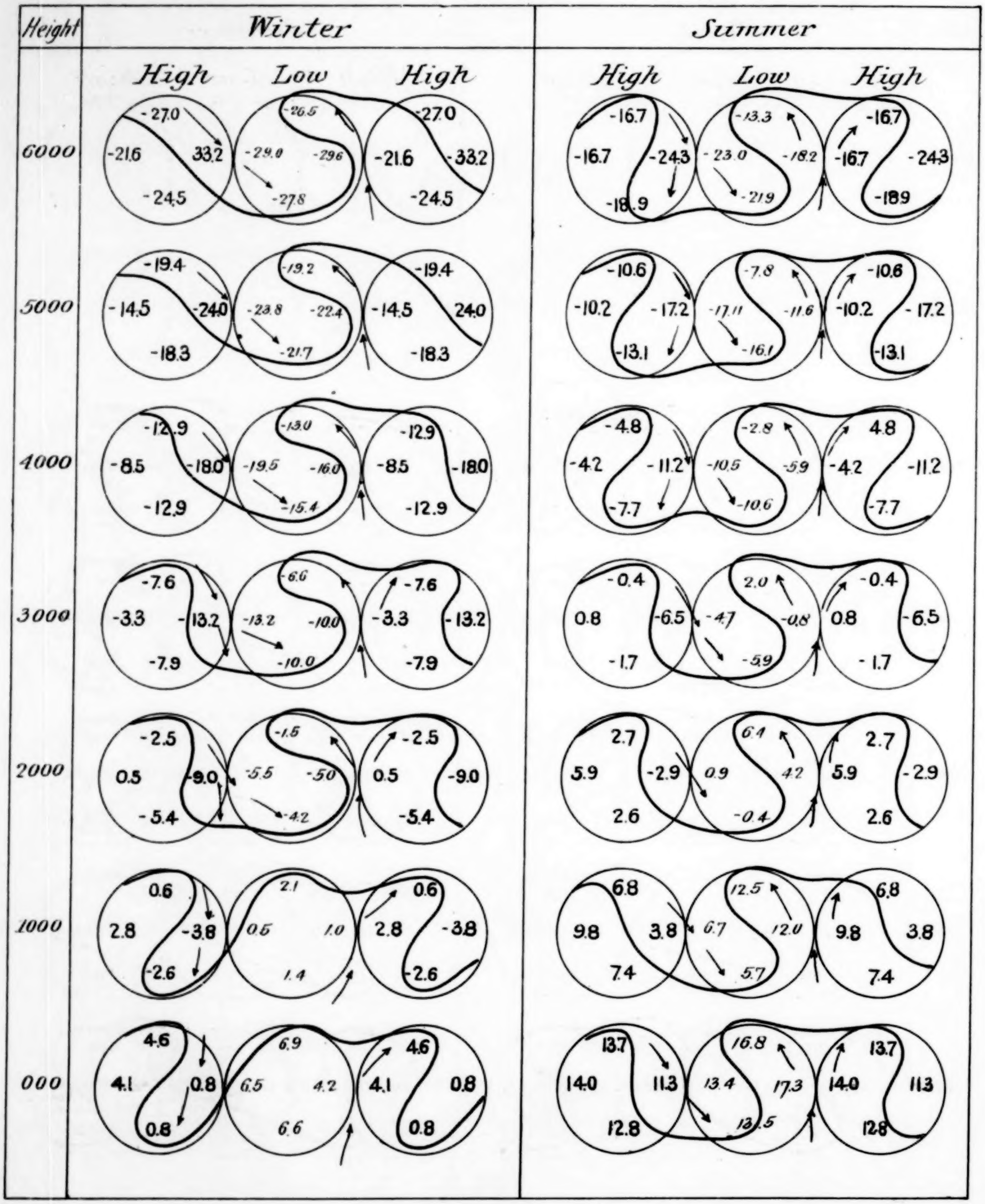

TABLE 4.—*Temperature-falls at Hald and Berlin.*

HIGH AREAS IN SUMMER (APRIL TO SEPTEMBER).

Height in meters.	North.				East.				South.				West.				Mean.	
	Hald	*Berlin*	ΔT	T	*Hald*	*Berlin*	ΔT	T	*Hald*	*Berlin*	ΔT	T	*Hald*	*Berlin*	ΔT	T	T	$\frac{\Delta T}{100}$
	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.
6000	−15.9	−17.5	−30.4	−16.7	−25.4	−23.1	−35.6	−24.3	−18.2	−19.5	−31.7	−18.9	−16.4	−16.9	−30.7	−16.7	−19.2	−0.65
5800			−29.2	−15.5			−34.0	−22.7			−30.5	−17.7			−29.4	−15.4	−17.9	−0.65
5600			−27.9	−14.2			−32.4	−21.1			−29.3	−16.5			−28.0	−14.0	−16.6	−0.65
5400			−26.7	−13.0			−31.0	−19.7			−28.1	−15.3			−26.7	−12.7	−15.3	−0.65
5200			−25.5	−11.8			−29.7	−18.4			−27.0	−14.2			−25.4	−11.4	−14.0	−0.60
5000	−9.7	−11.5	−24.3	−10.6	−18.5	−15.9	−28.5	−17.2	−12.2	−14.0	−25.9	−13.1	−9.6	−10.7	−24.2	−10.2	−12.8	−0.60
4800			−23.2	−9.5			−27.3	−16.0			−24.9	−12.1			−22.9	−8.9	−11.6	−0.60
4600			−22.1	−8.4			−26.1	−14.8			−23.8	−11.0			−21.6	−7.6	−10.4	−0.60
4400			−20.9	−7.2			−24.9	−13.6			−22.7	−9.9			−20.4	−6.4	−9.2	−0.60
4200			−19.7	−6.0			−23.7	−12.4			−21.6	−8.8			−19.3	−5.3	−8.1	−0.55
4000	−3.6	−6.0	−18.5	−4.8	−12.8	−9.6	−22.5	−11.2	−6.4	−9.0	−20.5	−7.7	−4.5	−3.9	−18.2	−4.2	−7.0	−0.50
3800			−17.3	−3.6			−21.3	−10.0			−19.2	−6.4			−17.2	−3.2	−6.0	−0.55
3600			−16.2	−2.5			−20.2	−8.9			−17.9	−5.1			−16.2	−2.2	−4.9	−0.50
3400			−15.3	−1.6			−19.3	−8.0			−16.7	−3.9			−15.2	−1.2	−3.9	−0.50
3200			−14.6	−0.9			−18.5	−7.2			−15.5	−2.7			−14.2	−0.2	−2.9	−0.45
3000	1.2	−2.0	−14.1	−0.4	−8.5	−4.5	−17.8	−6.5	−0.7	−2.6	−14.5	−1.7	0.1	1.5	−13.2	0.8	−2.0	−0.40
2800			−13.5	0.2			−17.3	−6.0			−13.6	−0.8			−12.1	1.9	−1.2	−0.40
2600			−12.9	0.8			−16.9	−5.6			−12.8	0.0			−11.0	3.0	−0.4	−0.40
2400			−12.3	1.4			−16.2	−4.9			−12.1	0.7			−10.0	4.0	0.4	−0.40
2200			−11.7	2.0			−15.3	−4.0			−11.2	1.6			−9.0	5.0	1.2	−0.45
2000	4.5	0.8	−11.0	2.7	−5.4	−0.3	−14.1	−2.9	3.7	1.5	−10.2	2.6	5.2	6.6	−8.1	5.9	2.1	−0.45
1800			−10.3	3.4			−12.9	−1.6			−9.3	3.5			−7.4	6.6	3.0	−0.50
1600			−9.6	4.1			−11.6	−0.3			−8.3	4.5			−6.6	7.4	4.0	−0.45
1400			−8.8	4.9			−10.2	1.1			−7.4	5.4			−5.8	8.2	4.9	−0.50
1200			−7.9	5.8			−8.9	2.4			−6.4	6.4			−5.0	9.0	5.9	−0.55
1000	7.4	6.1	−6.9	6.8	2.2	5.3	−7.5	3.8	7.2	7.5	−5.4	7.4	8.4	11.1	−4.2	9.8	7.0	−0.60
800			−5.7	8.0			−6.1	5.2			−4.4	8.4			−3.3	10.7	8.2	−0.55
600			−4.5	9.2			−4.6	6.7			−3.3	9.5			−2.5	11.5	9.3	−0.60
400			−3.2	10.5			−3.1	8.2			−2.2	10.6			−1.6	12.5	10.5	−0.60
200			−1.7	12.0			−1.6	9.7			−1.1	11.7			−0.8	13.2	11.7	−0.65
0	13.5	13.9	−0.0	13.7	9.1	13.5	0.0	11.3	10.5	15.1	0.0	12.8	11.4	16.5	0.0	14.0	13.0	......
									Mean gradient up to 4000 meters									−0.50

LOW AREAS IN SUMMER.

Height in meters.	North.				East.				South.				West.				Mean.	
	Hald	*Berlin*	ΔT	T	*Hald*	*Berlin*	ΔT	T	*Hald*	*Berlin*	ΔT	T	*Hald*	*Berlin*	ΔT	T	T	$\frac{\Delta T}{100}$
6000	−17.0	−9.5	−30.1	−13.3	−18.9	−17.5	−35.5	−18.2	−22.0	−21.8	−35.4	−21.9	−24.5	−21.4	−36.0	−23.0	−18.1	−0.50
5800			−29.0	−12.2			−34.1	−16.8			−34.3	−20.8			−35.3	−21.9	−17.1	−0.45
5600			−27.9	−11.1			−32.8	−15.5			−33.1	−19.6			−34.1	−20.7	−16.2	−0.50
5400			−26.7	−9.9			−31.4	−14.1			−31.9	−18.4			−32.9	−19.5	−15.2	−0.50
5200			−25.6	−8.8			−30.1	−12.8			−30.7	−17.2			−31.7	−18.3	−14.2	−0.50
5000	−12.1	−3.5	−24.6	−7.8	−11.9	−11.3	−28.9	−11.6	−16.3	−15.9	−29.6	−16.1	−19.3	−14.8	−30.5	−17.1	−13.2	−0.55
4800			−23.8	−7.0			−27.7	−10.4			−28.5	−15.0			−29.2	−15.8	−12.1	−0.55
4600			−22.9	−6.1			−26.5	−9.2			−27.4	−13.9			−27.9	−14.5	−11.0	−0.60
4400			−21.8	−5.0			−25.4	−8.1			−26.3	−12.8			−26.5	−13.1	−9.8	−0.60
4200			−20.7	−3.9			−24.3	−7.0			−25.2	−11.7			−25.2	−11.8	−8.6	−0.55
4000	−7.5	2.0	−19.6	−2.8	−6.4	−5.4	−23.2	−5.9	−11.0	−10.2	−24.1	−10.6	−12.7	−8.2	−23.9	−10.5	−7.5	−0.50
3800			−18.7	−1.9			−22.2	−4.9			−23.1	−9.6			−22.8	−9.4	−6.5	−0.50
3600			−17.8	−1.0			−21.1	−3.8			−22.2	−8.7			−21.7	−8.3	−5.5	−0.55
3400			−16.8	0.0			−20.1	−2.8			−21.3	−7.8			−20.5	−7.1	−4.4	−0.50
3200			−15.8	1.0			−19.1	−1.8			−20.4	−6.9			−19.3	−5.9	−3.4	−0.50
3000	−3.1	7.0	−14.8	2.0	−1.5	0.0	−18.1	−0.8	−5.8	−5.9	−19.4	−5.9	−6.4	−3.0	−18.1	−4.7	−2.4	−0.50
2800			−14.0	2.8			−17.2	0.1			−18.3	−4.8			−16.9	−3.5	−1.4	−0.45
2600			−13.2	3.6			−16.3	1.0			−17.2	−3.7			−15.8	−2.4	−0.5	−0.50
2400			−12.3	4.5			−15.4	1.9			−16.1	−2.6			−14.7	−1.3	0.5	−0.55
2200			−11.4	5.4			−14.3	3.0			−15.0	−1.5			−13.6	−0.2	1.6	−0.60
2000	1.2	11.8	−10.4	6.4	4.0	4.4	−13.1	4.2	−0.2	−0.5	−13.9	−0.4	−0.9	2.7	−12.5	0.9	2.8	−0.60
1800			−9.2	7.6			−11.5	5.8			−12.8	0.7			−11.4	2.0	4.0	−0.60
1600			−8.0	8.8			−9.8	7.5			−11.6	1.9			−10.4	3.0	5.3	−0.65
1400			−6.7	10.1			−8.1	9.2			−10.4	3.1			−9.2	4.2	6.6	−0.65
1200			−5.4	11.4			−6.6	10.7			−9.1	4.4			−8.0	5.4	7.9	−0.65
1000	6.3	18.7	−4.3	12.5	10.2	13.7	−5.3	12.0	5.2	6.2	−7.8	5.7	4.3	9.0	−6.7	6.7	9.2	−0.65
800			−3.4	13.4			−4.2	13.1			−6.4	7.1			−5.3	8.1	10.4	−0.60
600			−2.5	14.3			−3.2	14.1			−4.8	8.7			−4.0	9.4	11.6	−0.60
*400			−1.7	15.1			−2.1	15.2			−3.3	10.2			−2.7	10.7	12.9	−0.65
200			−0.8	16.0			−1.0	16.3			−1.7	11.8			−1.4	12.0	14.1	−0.60
0	12.4	21.2	0.0	16.8	14.9	19.6	0.0	17.3	13.0	14.0	0.0	13.5	12.4	14.4	0.0	13.4	15.3	......
									Mean gradient up to 4000 meters..........................									−0.57

than above or below it, a result indicated by the observed velocities as shown on chart 68 of my Cloud Report. It is hardly possible to consider the temperatures for the upper levels, 4000 to 6000 meters, as sufficiently reliable to base special emphasis upon the wide divergence of the European temperatures in those levels, and the lines should probably be drawing together more rapidly than here shown. From other considerations it may be inferred that the temperature differences generally disappear in the neighborhood of the cirrus levels 9000 to 10,000 meters. While there is a tendency in the lower levels for the temperatures of the high areas to diminish less rapidly than those of the low areas, there is yet but little to justify the view that anything like an inversion of temperature occurs, such as Professor Hann found in mountain stations and ascribed to dynamic actions, or such as Bjerknes and Clayton assume to exist in their theories of cold-center and warm-center cyclones superposed upon each other. This will be seen more clearly in the exhibit of figs. 3 and 4. We may safely infer from fig. 1 that there is little to distinguish the temperature distribution in European cyclones and anticyclones from that prevailing in the American high and low areas.

Using the same temperature-falls we now discuss the relation according to actual warm and cold areas, as shown in

fig. 2, where the dotted lines indicate the warm areas and the full lines the cold areas. Hence we adopt the following arrangement: (See Table 6.)

TABLE 5.—*Surface temperatures in centigrade degrees for day and night at Hald and Berlin.*

HIGH AREAS.

Station.	Winter.				Summer.			
	N.	*E.*	*S.*	*W.*	*N.*	*E.*	*S.*	*W.*
Hald, day	5.1	3.8	1.1	1.3	14.9	10.4	14.0	12.6
Hald, night	2.1	(0.0)	−1.7	5.1	(12.0)	(7.8)	(6.9)	(10.2)
Berlin, day	6.6	1.7	1.9	4.2	17.1	16.6	18.5	19.0
Berlin, night	4.6	−2.5	1.8	5.9	10.6	10.3	11.6	14.0
Means	4.6	0.8	0.8	4.1	13.7	11.3	12.8	14.0

LOW AREAS.

Station.	*N.*	*E.*	*S.*	*W.*	*N.*	*E.*	*S.*	*W.*
Hald, day	6.1	5.5	5.2	4.5	14.6	15.8	14.0	12.8
Hald, night	(4.0)	3.7	6.0	5.8	10.1	14.0	12.0	(12.0)
Berlin, day	12.8	2.7	8.6	9.2	26.5	20.9	15.5	14.9
Berlin, night	4.7	4.7	(6.6)	(6.5)	15.8	18.3	12.5	(14.0)
Means	6.9	4.2	6.6	6.5	16.8	17.3	13.5	13.4

TABLE 6.—*Distribution of the sectors by warm and cold areas.*

Blue Hill, winter.		Hald and Berlin, winter.	
Warm areas.	Cold areas.	Warm areas.	Cold areas.
High north. High west. Low east. Low south.	High east. High south. Low west. Low north.	High north. High south. High west. Low north.	High east. Low east. Low south. Low west.
Blue Hill, summer.		**Hald and Berlin, summer.**	
High north. High west. Low east. Low south.	High east. High south. Low north. Low west.	High north. High west. Low north. Low east.	High east. High south. Low south. Low west.

This summary shows that as a whole the warm and cold temperatures are about equally distributed between the high areas and low areas, especially in the levels above 1000 meters. Below that level, in the stratum near the ground, there is much less regularity in the distribution, and this probably means that the true cyclonic and anticyclonic action is disturbed by coming in contact with the ground, and by the adjustment to surface conditions. *It also shows that the surface temperatures are not entirely reliable as records of the real distribution prevailing in the free air, and it implies that for accurate forecasting it will be necessary to change from the exclusive use of surface temperature charts to those determined by observations in the free air at somewhat moderate elevations, such as can be easily obtained by kite flights up to 1000 or 2000 meters.*

TEMPERATURE DIFFERENCES AT THE SAME ELEVATION.

The results of the computations may be exhibited even more clearly by plotting the temperatures on the several 1000-meter levels, and drawing a line to separate the high temperature from the low temperature regions. Fig. 3 shows the distribution for the American and fig. 4 for the European cyclonic and anticyclonic regions. The loss of the data in the north sector of the American cyclone makes this line of demarcation uncertain in that area, but by analogy with the European data and from what we know of conditions at the surface it is probably quite like that indicated in the diagram. In spite of the fact that we have been using an insufficient amount of observations to render the temperature distribution entirely normal, it is yet evident that the *distribution is fundamentally the same in the American and European circulation. There is an inflow of cold air from the northwest between the centers of barometric high and low pressure, and an inflow of warm air from the south, likewise between the centers of low and high pressure. There are no cold-center anticyclones in any level, nor any warm-center cyclones in any level. There is no inversion of type from the surface to the highest level reached, with the possible exception of the surface and the 1000-meter level of the European cyclones in the winter.* I am at a loss to explain this last result, and suspect that it may be due to our imperfect elimination of the diurnal temperature variation from the data contained in Grenander's paper, or in the Hald and Berlin reports. This exception seems to constitute the basis for the claim that has been advanced for Professor Hann's theory that the warm-center cyclone below is replaced by a cold-center cyclone above, and that this inversion of temperature implies a dynamic system as the source of the level cooling. The fact is that the cool northwest winds in the upper levels follow the stream lines marked out in the diagrams of the Weather Bureau International Cloud Report, as given in chart 15, or in the MONTHLY WEATHER REVIEW, March, 1902. *They become more and more sinuous in descending from the cirrus levels to the surface, or below the strato-cumulus level, 3000 meters, curling more decidedly in an anticyclonic rotation with a tendency to divide into two branches. The southerly winds in the same way divide into two branches one curling into the cyclone on the northeast and the other into the anticyclone on the northwest of the respective centers.*

The mechanical cyclone and anticyclone, with centers of high and low pressure at the boundary between these cold and warm currents, are the dynamic effect of the vertical and horizontal motion of these currents of different temperature, just as has been explained in my previous papers. The observed vectors of velocity are such as to produce or accompany the temperature distribution here described, and the cold and the warm currents having different temperatures bear within themselves the source of the energy of storms. The fact is that storms are produced by *horizontal convection* more than by *vertical convection*. The latent heat of condensation is an additional source of energy, and the underflowing of warm currents beneath the eastward drift is another small source of energy, but these are distinctly subordinate to the horizontal or lateral convection between these counterflowing masses or sheets of air. The cyclone and anticyclone are the dynamic effects of this thermodynamic energy, and this function constitutes the true problem in meteorology for study. It is, therefore, evident that the different statements found in the literature of the subject regarding the cyclone being cooler than the anticyclone in the upper levels, have been imperfect and rough efforts to reach the facts here shown. Since the counterflow does have somewhat different configurations in the several levels, there is a difference of temperature to be obtained on proceeding from the surface upward over the same sector. But it is not proper to compare the temperatures of cyclones as a whole, from level to level, nor of anticyclones, without careful discrimination as to the subareas which are involved. It is important, likewise, to obtain the gradients over the warm and cold areas, separately, rather than over the cyclones and anticyclones taken as wholes, as was done in Tables 1, 2, 3, 4.

VERTICAL TEMPERATURE GRADIENTS PER 100 METERS.

Taking the mean gradients over the high areas and the low areas for the American and European temperatures, and limiting the means to the 4000-meter level for the sake of the comparison, we obtain from Tables 1, 2, 3, 4:

Winter.			Summer.		
	High areas.	Low areas.		High areas.	Low areas.
	° *F.*	° *F.*		° *F.*	° *F.*
American	− 0.42	− 0.43	American	− 0.62	− 0.63
European	− 0.40	− 0.55	European	− 0.50	− 0.57

TABLE 7.—*Temperatures and gradients in the American and European cyclones and anticyclones arranged by the warm and cold areas.*

Height in meters.	Blue Hill, winter.				Hald and Berlin, winter.				Blue Hill, summer.				Hald and Berlin, summer.			
	Warm.		Cold.		Warm.		Cold.		Warm.		Cold.		Warm.		Cold.	
	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C	° C.	° C.	° C.	° C.	° C.	° C.	° C.	° C.
6000	......	......	......	......	−24.9	−0.75	−29.0	−0.70	......	......	......	......	−16.2	−0.60	−22.0	−0.60
5800	......	......	......	......	−23.4	−0.80	−28.5	−0.70	......	......	......	......	−15.0	−0.65	−20.8	−0.65
5600	......	......	......	......	−21.8	−0.70	−27.1	−0.70	......	......	......	......	−13.7	−0.65	−19.5	−0.65
5400	......	......	......	......	−20.4	−0.65	−25.7	−9.65	......	......	......	......	−12.4	−0.60	−18.2	−0.60
5200	......	......	......	......	−19.1	−0.60	−24.2	−0.60	......	......	......	......	−11.2	−0.55	−17.0	−0.55
5000	......	......	......	......	−17.9	−0.55	−23.0	−0.55	......	......	......	......	−10.1	−0.55	−15.9	−0.60
4800	......	......	......	......	−16.8	−0.60	−21.9	−0.60	......	......	......	......	−9.0	−0.60	−14.7	−0.55
4600	......	......	......	......	−15.6	−0.65	−20.7	−0.60	......	......	......	......	−7.8	−0.55	−13.6	−0.60
4400	......	......	......	......	−14.3	−0.65	−19.5	−0.60	......	......	......	......	−6.7	−0.55	−12.4	−0.60
4200	......	......	......	......	−13.0	−0.60	−18.3	−0.55	......	......	......	......	−5.6	−0.60	−11.2	−0.60
4000	−11.9	−0.50	−17.6	−0.55	−11.8	−0.50	−17.2	−0.50	−4.3	−0.70	−9.2	−0.70	−4.4	−0.50	−10.0	−0.55
3800	−10.9	−0.45	−16.5	−0.55	−10.8	−0.55	−16.2	−0.55	−2.9	−0.60	−7.8	−0.65	−3.4	−0.50	−8.9	−0.55
3600	−10.0	−0.50	−15.4	−0.50	−9.7	−0.55	−15.1	−0.55	−1.7	−0.65	−6.5	−0.75	−2.4	−0.50	−7.8	−0.55
3400	−9.0	−0.50	−14.4	−0.50	−8.6	−0.55	−14.0	−0.60	−0.4	−0.60	−5.0	−0.70	−1.4	−0.50	−6.7	−0.50
3200	−8.0	−0.55	−13.4	−0.55	−7.5	−0.55	−12.8	−0.60	0.8	−0.65	−3.6	−0.70	−0.4	−0.40	−5.7	−0.50
3000	−6.9	−0.45	−12.3	−0.50	−6.4	−0.40	−11.6	−0.60	2.1	−0.55	−2.2	−0.65	0.4	−0.45	−4.7	−0.45
2800	−6.0	−0.45	−11.3	−0.45	−5.6	−0.40	−10.4	−0.60	3.2	−0.60	−0.9	−0.70	1.3	−0.40	−3.8	−0.45
2600	−5.1	−0.45	−10.4	−0.50	−4.8	−0.40	−9.2	−0.55	4.4	−0.55	0.5	−0.65	2.1	−0.40	−2.9	−0.45
2400	−4.2	−0.50	−9.4	−0.40	−4.0	−0.40	−8.1	−0.60	5.5	−0.60	1.8	−0.65	3.0	−0.45	−2.0	−0.50
2200	−3.2	−0.45	−8.6	−0.45	−3.2	−0.45	−6.9	−0.50	6.7	−0.55	3.1	−0.65	3.9	−0.45	−1.0	−0.55
2000	−2.3	−0.50	−7.7	−0.40	−2.3	−0.35	−5.9	−0.50	7.8	−0.60	4.4	−0.60	4.8	−0.55	0.1	−0.55
1800	−1.3	−0.50	−6.9	−0.40	−1.6	−0.35	−4.9	−0.50	9.0	−0.50	5.6	−0.70	5.9	−0.55	1.2	−0.55
1600	−0.3	−0.25	−6.1	−0.40	−0.9	−0.35	−3.9	−0.60	10.0	−0.55	7.0	−0.65	7.0	−0.55	2.3	−0.60
1400	0.2	−0.15	−5.4	−0.35	−0.2	−0.20	−2.7	−0.60	11.1	−0.50	8.3	−0.65	8.1	−0.55	3.5	−0.60
1200	0.5	−0.20	−4.8	−0.30	0.2	−0.25	−1.5	−0.60	12.1	−0.45	9.6	−0.40	9.2	−0.55	4.7	−0.60
1000	0.9	−0.20	−4.6	−0.10	0.7	−0.40	−0.3	−0.55	13.0	−0.40	10.4	−0.40	10.3	−0.50	5.9	−0.65
800	1.3	−0.35	−4.3	−0.15	1.5	−0.35	0.8	−0.50	13.8	−0.55	11.2	−0.50	11.3	−0.50	7.2	−0.70
600	2.0	−0.50	−3.8	−0.25	2.2	−0.35	1.8	−0.55	14.9	−0.55	12.2	−0.60	12.3	−0.50	8.6	−0.65
400	3.0	−0.65	−2.9	−0.55	2.9	−0.30	2.9	−0.40	16.0	−0.70	13.4	−0.60	13.3	−0.55	9.9	−0.70
200	4.2	−0.65	−1.8	−0.65	3.5	−0.30	3.7	−0.35	17.4	−0.65	14.6	−0.55	14.4	−0.55	11.3	−0.75
0	5.5	......	−0.5	......	4.1	......	4.4	......	18.7	......	15.7	......	15.5	......	12.8	......

The American mean gradient is about the same for high and low areas at all seasons of the year, though the summer gradient is greater than the winter in the ratio of 3 to 2. This is a function of the observed difference of velocity for these two seasons. The European gradient is larger in cyclones than in anticyclones for both seasons, and there is not so much difference between them in the summer as in the winter. These variations depend upon the local conditions which control the origin and mixing of the countercurrents themselves. Surveying the gradient lines as a whole, I believe that they show that, after escaping from the surface confusion, the lines spread gradually up to 3000 meters, or the strato-cumulus level, where the difference is a maximum and that they then draw slowly together up to about the cirrus level where the eastward drift is usually undisturbed. This conforms to my solution obtained for the local cyclonic velocities, which showed that the *maximum gyration is in the cirro-cumulus level, and that it diminishes downward and upward without reversal.*[5] The discussion of these velocities and temperatures, together with the corresponding pressures will be undertaken in a later paper of this series. It is now evident that any adiabatic solution of the problem is inadequate, and that the omission of the heat added, $\Delta Q=0$, is fatal to a satisfactory discussion of natural cyclones and anticyclones, because the observed gradients differ from the adiabatic gradient, 0.987 degree centigrade per 100 meters. Furthermore, the surrounding of fixed masses of air with artificial boundaries for the sake of a ready integration, also takes the problem out of the class of those required in meteorology, and makes merely special ideal cases which are out of our consideration. It has seemed to me proper to wait for the acquisition of approximate values of the velocity, temperature, and pressure before trying to do anything with the analytical solutions. Since it is the divergence of the local temperatures away from the mean temperature of the atmosphere which produces the local circulations, we should evidently compute the gradients in the warm and cold areas regardless of their distribution around the centers of pressure.

[5] Compare chart 68, International Cloud Report, figs. 6, 7; and Tables 11, 12, Monthly Weather Review, March, 1902.

TABLE 8.—*Temperature differences, cold minus warm areas.*

Height.	Winter.		Summer.	
	Blue Hill.	Hald and Berlin.	Blue Hill.	Hald and Berlin.
	° F.	° F.	° F.	° F.
6000	....	−5.0	.....	−5.8
5000	....	−5.1	.....	−5.8
4000	−5.7	−5.4	−4.9	−5.6
3000	−5.4	−5.2	−4.3	−5.1
2000	−5.4	−3.6	−3.4	−4.7
1000	−5.5	−1.0	−2.6	−4.4
0	−6.0	+0.3	−3.0	−2.7

VERTICAL TEMPERATURE GRADIENTS IN THE WARM AND COLD AREAS.

By taking the mean temperatures at the different levels, arranged according to the warm and cold area groups indicated in Table 6, we obtain the temperatures and gradients of Tables 7 and 8. There are several results which can be readily seen on the face of the tables: (1) The temperatures at Blue Hill, Hald and Berlin are in sufficient agreement as to the absolute values in the several levels, to enable us to infer that the American and European systems are in harmony so far as the temperature is concerned. (2) The difference between the temperatures in the warm and cold areas is about 5.4° on the 4000-meter level, and it diminishes toward the surface, except at Blue Hill in winter. For Hald and Berlin in winter there is the anomalous inversion already mentioned. For summer, at all stations, the temperature difference is about 3° in the lower levels. (3) The gradient at Blue Hill in winter is —0.65° near surface, —0.20° at the 1000-meter level, and —0.50° at 4000 meters. Hald and Berlin show a compara, tively steady increase of the gradient from the surface- —0.35°, to —0.75° at 6000 meters, with a slight diminution in the 1000 to 2000-meter stratum for the warm areas; in the cold areas the gradient is about —0.60° in the upper levels throughout a deep stratum. In summer the gradient at the surface is about —0.60°, at the 1000-meter level —0.40°, and at 4000 meters —0.65, at Blue Hill; at Hald and Berlin there is a diminution of the gradient up to the 3000-meter level and an increase up to the 6000-meter level for warm and cold areas. These facts are of special significance in the thermodynamics of

cyclonic circulations. These *temperature* gradients may profitably be compared with the gradients in high or low *pressure* areas taken as a whole. The departure of the temperature in each sector from the prevailing mean air temperature is evidently the basis for a thermodynamic discussion of the cyclonic problem.

RESULTS.

We conclude that there is no fundamental difference in the structure of American and European cyclones and anticyclones. The observed temperature distribution is in harmony with the observed atmospheric currents, and is due to an intermixture of currents from warm and cold latitudes, the energy of storms being thus referred to the heat transported from different latitudes. The pressure centers of motion occur on the boundaries of these countercurrents, and thus represent the dynamic effects of the thermodynamic energy. Instead of vertical convection being the primary cause of storms it is rather horizontal convection, interchange of heat energy on the same levels, as suggested in my preceding papers. There is no evidence of the superposition of cold-center cyclones upon warm-center cyclones, as expounded by Clayton or by Bjerknes and Arrhenius, nor are there purely dynamic vortices in a rapid stream as supposed by Hann, nor are there cyclonic vortices caused by atmospheric islands of high pressure obstructing a rapidly flowing eastward drift as explained by Shaw, or by Hildebrandsson in his report to the International Committee, 1905.

ATMOSPHERIC ELECTRICITY.

By GEORGE C. SIMPSON, M. S., Lecturer in meteorology in the University of Manchester, England. Dated January 17, 1906.

The study of meteorology may be pursued with two entirely different ends in view. We may pursue it for utilitarian purposes, or we may pursue it as a pure science for the knowledge to be derived from it. It must be admitted that there are a number of so-called meteorologists whose point of view is the former, and whose highest ambition is the production of an almanac giving the state of the weather for each day a year in advance. Although some of the great advances of knowledge which have been of practical use to mankind have been made by the utilitarian student, yet experience has shown that without the pure scientist little real advance can be made. The true men of research, working for the sake of science itself, have always been the pioneers to open up new country and reveal new treasures, which the utilitarian has then appropriated and used. In meteorology we must not expect and seek for merely practical knowledge, but must investigate the atmosphere in a truly scientific manner, considering no phenomenon found in it to be unworthy of investigation. Thus although the electrical conditions of the atmosphere on a fine day are insignificant in comparison with the great motions of the atmosphere, or with the local conditions which determine the climate and weather of any place, yet meteorology can not be complete without a true knowledge of these conditions. While meteorologists must always be more concerned with the great changes in the motion, temperature, pressure, and humidity of the air, they must also not forget that electricity plays an important part in natural phenomena. Since the time of Franklin great progress has been made in our knowledge of the electrical conditions of the atmosphere, but so far the progress has led to no utilitarian results, and the problems of the thunderstorm are not yet solved. In the present article an attempt is made to sketch, in as few words and as simply as possible, the lines along which research has traveled.

One of the first lessons we learn on being introduced to the science of electricity is that a positively charged body placed between two others, one having a positive and the other a negative charge, will tend to move toward the latter. This we are told is due to the "electrical field" set up by the oppositely charged bodies.

The experiments of Franklin showed that such an electrical field exists in the atmosphere during thunderstorms. Later observers have shown that not only during thunderstorms, but also under normal circumstances, there is an electrical field in the lower atmosphere, such that a positively charged body would be attracted toward the surface of the earth. The electrical field of the lower atmosphere points to the permanent presence of a layer of negative electricity on the surface of the earth with a corresponding positive charge somewhere above the surface, but exactly where this positive charge is has been the subject of much controversy.

For a long time it was thought that the negative charge on the earth is a charge left there when the earth first became a separate member of the solar system. If that had been so then the corresponding charge of positive electricity would be somewhere right outside the earth and its surrounding atmosphere, in fact somewhere in cosmical space. We should thus have expected an electrical field, similar to that found near the surface of the earth, extending with only slightly diminished intensity to heights much greater than those of our atmosphere; but observations made in balloons have proved most conclusively that the electrical field found near the surface has nearly disappeared at a height of four and one-half miles (reached by Gerdien, November 5, 1903). This means that the outside positive charge corresponding to the negative charge on the surface of the earth is not outside the atmosphere, but is *distributed through the whole mass of air in the lower atmosphere.*

This result leads us to consider under what conditions electricity can exist in the atmosphere. Until 1900 the conception was firmly held by physicists that the air of the atmosphere in its normal state is a perfect nonconductor of electricity, and that if a charged body, perfectly insulated, were placed in air quite free from dust the charge would be retained indefinitely. That such a body never does permanently keep its charge was always ascribed to the presence of dust in the air. It was supposed that particles of dust coming into contact with the body take a part of the charge and are then repelled, and that thus in course of time the charge is in this way entirely dissipated on to the dust of the air. But in 1900 Elster and Geitel in Germany and C. T. R. Wilson in England showed that not only does a perfectly insulated body in perfectly pure air lose its charge, but that the presence of dust diminishes the rate of loss instead of increasing it.

Just before this time new ideas had been formed as to what takes place during the discharge of electricity through gases. It had been demonstrated that most, if not all, the phenomena then known to accompany the discharge of electricity through gases could be explained by assuming that an electrically neutral molecule of a gas can be split up into two other molecules or two atoms, each of which carries an electrical charge, one negative and the other positive. To these charged molecules the name "ion" had been given, an "ion" being understood to be any small material particle, generally of molecular dimensions, which carries a charge of electricity.

Elster, Geitel, and Wilson at once pressed this theory into service to explain the results of their experiments. They assumed that a small proportion of the molecules of ordinary air are always being split up into ions. Thus when a charged body is introduced into air the electricity on it attracts ions of the opposite sign which neutralize the charge, or in other words the charge is dissipated. Numerous experiments were made to prove or disprove this theory, but it has withstood all the tests and is now generally accepted. Elster and Geitel proceeded to work out in full the bearings of this new theory on the problems of atmospheric electricity. It at once became obvious that if there are always both kinds of ions in the atmosphere the negative charge on the earth will attract the positive ions toward itself, become neutralized and so disap-

pear. That such a process is always taking place has been clearly shown, and Elster and Geitel designed an instrument for measuring the rate at which the charge on the earth is being dissipated. The recognition of this process led to an important advance in the study of atmospheric electricity; it indicated that there must be some influence at work in the lower atmosphere the presence of which had never been suspected before.

The new position of affairs may be summed up as follows. We find a layer of negative electricity spread over the entire surface of the globe with a corresponding charge of positive electricity distributed through the mass of the lower atmosphere. At the same time we find the molecules of the air splitting up into positive and negative ions, the former of which must be attracted to the negative charge on the surface of the earth, while the latter attach themselves to the positive charge in the air; so that if these were all the processes then the charge on the surface and the charge in the air would both be neutralized within a very short time. The fact that they are not neutralized points to some influence constantly at work in the lower atmosphere, which renews the charge on the earth and that in the air as fast as they are neutralized.

This influence is at present entirely unknown, but perhaps no single physical problem has been more assiduously attacked and more freely discussed. The search for the solution has been keen and energetic; it has led to great experimental and observational activity; it has led also to the publication of innumerable theories, most of which have rapidly succumbed to hostile attacks. We can not here go at length into the controversy which has developed around this problem, but we must indicate the lines along which a satisfactory theory must be drawn. We have constantly in the air free positive and negative electricity in the form of ions; all that is required to solve the problem is to discover some means by which the negative ions are separated from their positive fellows and conveyed to the surface of the earth. At present only one theory can be said to be worthy of serious consideration. This is the theory first put forward by C. T. R. Wilson and lately revived and strongly advocated by Gerdien. According to this theory under certain conditions of supersaturation the water vapor of the atmosphere is deposited on the negative ions, these then become the nuclei of raindrops and are ultimately carried to the earth. This theory has a great deal to commend it, but it does not explain all the facts, and is not as yet very generally accepted.

When it was once realized what an important bearing the amount of ionization of the air has on the electrical state of the atmosphere many physicists in Germany undertook long investigations into the variations of the number of ions present in the atmosphere, and endeavored to find how the number varied with different meteorological conditions. The result of this work has given very definite knowledge on these points.

In the first place it has been found that the number of ions present and the freedom with which they move through the air vary greatly from season to season. The summer is accompanied by the greatest conductivity of the atmosphere, while the lowest occurs in midwinter. As the rate at which the electricity is dissipated from the surface depends on the conductivity of the air—i. e., on the number of ions present and their mobility—one would expect greater dissipation in the summer than in the winter; and this is shown to be true by measurements of the electrical field just above the surface, which indicate much greater surface charges during the winter than during the summer. Cold, hazy, foggy, and damp weather are all accompanied by low ionization, while the reverse is the case with warm, bright, and clear weather.

It has long been known that the aurora is an electrical phenomenon of the upper atmosphere, and it was thought very probable that it would influence the electrical conditions of the lower atmosphere; but during a year spent in the region in which auroras are most frequent the present writer has been quite unable to detect any such influence, even though provided with the best and latest instruments.

A great deal of experimental work has been directed toward finding out the condition under which air and other gases can be ionized, and the conclusion reached is that no gas will spontaneously ionize, but that some active agent is necessary. The two best known agents by which gases can be ionized are the X rays and the rays given off from radio-active matter. The question naturally arises as to the agent at work in the atmosphere causing the ionization which we know is always taking place. Ingenious experiments have shown that the air always contains a varying amount of radio-active matter, and is penetrated by a strong X-ray-like radiation, the origin of which has not yet been determined.

The radio-active matter of the atmosphere has an interesting source, and its life history has been clearly indicated by Elster and Geitel

Among the materials of which the crust of the earth is composed are greater or less amounts of the primary radio-active bodies—radium, thorium, etc. These bodies constantly give off a vapor-like emanation, which for a comparatively short time exists as a radio-active gas and then disappears, at least as far as we are concerned. This emanation collects in the interstices of the soil and in all underground holes, from which it very slowly diffuses into the atmosphere above. When the barometric pressure falls there is naturally a flow of air, heavily charged with emanation, from the ground, so that the amount of emanation in the atmosphere is appreciably greater with a falling than with a rising barometer. The emanation which finds it way into the atmosphere undergoes changes during which it emits Becquerel rays which ionize the air. The study of the varying amounts of emanation in the atmosphere has been already carried very far, and the relation between the amount of emanation and the different meteorological factors is fairly well known. Several eminent physicists have suggested some relation between the amount of radio-active emanation in the atmosphere at any place and the climate there; they explain the "bracing" or "relaxing" condition at two places geographically similar by the differences in the amount of emanation to be found there. These ideas have as yet received no experimental support, still this is an interesting region for speculation.

There is still an immense number of problems to be solved in relation to atmospheric electricity; in fact very few of the problems have received satisfactory answers. The explanation of the aurora is still unknown, nor is there any agreement even as to whether its origin is terrestrial or cosmical. Whether the negative variations which have been so closely studied are connected in any way with atmospheric electricity is still quite unknown, and one can not see much hope for an early solution of the problem.

Even after a century of investigation, the ordinary thunderstorm is still as great a riddle to the modern physicist as it was to Franklin; we do not know how the electrical forces are brought into play, we can not even describe clearly what happens when a discharge takes place, so it is not surprising that we have absolutely no idea why a thunderstorm gives some people headaches and turns milk sour; we do not even know if these things are real or not. As to what globe lightning is we have not yet begun to make intelligent guesses. Nevertheless advances in the unknown regions are being made, and, if the progress of the last ten years continues, more than one of these difficulties will shortly be removed and our knowledge of atmospheric electricity rapidly increased.

ATMOSPHERIC ELECTRICITY IN HIGH LATITUDES.

[We print some extracts from a memoir by Mr. George C. Simpson, to whom we are also indebted for a special article in the present number of the REVIEW. Those who wish to acquire a clear idea of modern methods of work in the study of atmospheric electricity will necessarily obtain and read the whole of Mr. Simpson's memoir, which is published in volume 205, series A, of the Philosophical Transactions of the Royal Society of London.—EDITOR.]

Investigation into the problems of atmospheric electricity may be divided into two periods. The first period was devoted almost entirely to measurements of the normal potential gradient in the lower region of the earth's atmosphere, with the aim of finding its daily and yearly variations, its geographical distribution, and its dependence on meteorological conditions. To this period belongs the fine work of Lord Kelvin and Professor Exner.[1]

The second period commenced in 1899, when the interest in the problems of atmospheric electricity was at rather a low ebb, owing to the small real progress made during the few previous years. In that year the discovery that atmospheric air is always more or less ionized (made at about the same time by Elster and Geitel[2] in Germany and C. T. R. Wilson[3] in England) had a completely revolutionizing influence on the theories held to account for the earth's normal field. This discovery has brought about a great revival of interest and opened a totally new field for investigation.

As long as air could be considered a perfect nonconductor, Exner's theory that the charge on the earth is a residual charge held a very strong position, but with a conducting atmosphere it is untenable. An ionized atmosphere means a continual passage of electricity from the charged surface into the highest regions of the atmosphere, where only any residual charge could be held. The new discovery having proved conclusively that the charge on the earth is being continuously dissipated into the ionized air above, it became of prime importance to determine the rate at which the electricity is dissipated and the conditions under which the loss takes place.

The first serious attempt to do this was made by Elster and Geitel.[4] They designed an instrument consisting of a charged cylinder exposed to the air—protected from extraneous electrical fields—and so connected to an electroscope that the rate at which it lost its charge could be measured. By making certain assumptions it can be shown that the charge lost in a small interval of time from any charged body exposed to the air is always a definite fraction of the charge on the body. Thus, when Elster and Geitel had found the charge lost by their cylinder in a minute they were able to express the loss as a percentage of the charge on the cylinder, and then, by applying this percentage to the charge on the earth, were able to find the quantity of electricity being dissipated from every square meter of surface each minute.

Besides knowing the amount of electricity dissipated from the surface—which depends upon many factors—it became also of great importance to know to what extent the air is ionized at any moment. For this purpose Ebert[5] designed an instrument which gives the amount of ionization independently of anything else. A known quantity of air is drawn through a cylinder condenser, the inner cylinder of which is connected to an electroscope. As the air passes between the cylinders the charged inner one attracts to it all the ions of the opposite sign. These ions neutralize an equal amount of electricity, and so the charge lost by the inner cylinder is a measure of the number of ions contained in the known quantity of air which has been drawn through the instrument. In this way it is possible to find how many electrostatic units of each kind of electricity are free in a cubic meter of air.

These two instruments are very powerful weapons for attacking the new problems of atmospheric electricity, and have been used as such to a large extent on the Continent. Systematic observations of the dissipation were undertaken by Elster and Geitel, and quite a number of other physicists have devoted themselves to finding the relations existing between meteorological conditions, ionization, the rate of dissipation, and the potential gradient. As a result of this work the electrical conditions of the atmosphere are already fairly well known for lands lying within the temperate zone. With the idea of extending this knowledge to places within the Arctic Circle I was granted permission by the Commissioners of the 1851 Exhibition Scholarship to undertake a year's work [September 1903–October 1904] on atmospheric electricity in Lapland.

The work which I proposed to do was the following:

1. By means of a Benndorf self-registering electrometer to obtain daily curves of the potential gradient and from these to calculate the yearly and daily variations.
2. To make systematic observations of the dissipation by means of Elster and Geitel's instrument.
3. To make corresponding measurements of the ionization with Ebert's apparatus.
4. To measure the amount of radio-active emanation in the atmosphere.
5. To investigate, as far as possible, the influence of the aurora on the electrical conditions of the atmosphere.

In my choice of a station I decided to get as far north as possible without being actually on the seacoast, and found that the Lapp village of Karasjok (69° 17′ north, 25° 35′ east, 129 meters above sea level) was very well suited for my purpose.

METEOROLOGICAL CONDITIONS.

Before going on to a discussion of the electrical results obtained, it will be as well to give a short account of the meteorological conditions experienced during the year's work. From its high latitude the north of Norway should be a very cold district; but the presence of the open ocean on the north and west greatly modifies the temperature. The effect of the water is of course very much more marked on the seacoast than inland. As one recedes from the coast the mean temperature for the winter six months falls very rapidly, it being −2.3° C. at Gjesvoer, near the North Cape, and −11.7° C. at Karasjok. If there were no interchange of air between the ocean and the interior of the land the latter would of course have a very low temperature. This became very noticeable during periods of calm weather, for the temperature would then run down to very low values, reaching on several occasions −40° C., while, on the contrary, whenever the wind rose the temperature rose also.

When there was no wind, a cap of very cold air would form over the land, causing a nearly permanent temperature inversion. Although I could not observe this inversion instrumentally—neither kites nor balloons forming part of my equipment—there could be little doubt as to its reality. On September 30, 1903, with an air temperature of −6° C., a bright rainbow was observed. Then again, on descending the high banks of the river, one felt at once the cold air collected in the river basin, and the Lapps stated that it was seldom as cold on the hills as in the valleys. Then, again, the fact that a wind was always accompanied by mild weather also points to the cold of still weather being confined to a layer of air of no considerable depth lying over the surface. This condition of things almost entirely prevented the formation of ascending currents of air, thus causing very small values of the amount of precipitation and almost entirely preventing the

[1] For a good résumé of this period see Exner, Terr. Mag., 1900, vol. 5, p. 167.
[2] Phys. Zeit., 1899, vol. 1, p. 245. Phys. Zeit., 1900, vol. 2, p. 116.
[3] Roy. Soc. Proc., 1901, vol. 68, p. 151.
[4] Phys. Zeit., 1899, vol. 1, p. 11. Terr. Mag. and Atm. Elect., 1899, vol. 4, p. 213. Drude's Ann., 1900, vol. 2, p. 425.
[5] Short description, Phys. Zeit., 1901, vol. 2, p. 662; fuller description, Aeronautische Mittheilungen, 1902, p. 1.

formation of low clouds during the winter. It also had a very marked effect on the electrical condition of the atmosphere, to which reference will be made later.

During the summer the weather conditions were very similar to those of England, with the exception that the precipitation was very much less and thunderstorms were scarce. On three days only was thunder heard and lightning was not seen once.

From November 26, 1903, to January 18, 1904, the sun did not rise above the horizon; nevertheless, even in the darkest days there were two or three hours of twilight, during which the sky was too bright for the stars to be seen. The period during which the sun did not go below the horizon extended from May 20 to July 22, 1904.

[Perhaps we may summarize the conclusions that Mr. Simpson has drawn from his year's work in Lapland by quoting the following sentences.]

During the whole of my stay in Karasjok I could not detect the slightest effect of the aurora on any of the electrical conditions of the atmosphere, and most careful watching of the needle of the self-registering electrometer did not show any relation between the potential gradient and the aurora. * * *

The first and most important conclusion is that the difference in the electrical conditions of the atmosphere between mid-Europe and this northerly station can all be accounted for by the difference in the meteorological conditions at the two places. * * * The maximum of the transparency of the atmosphere corresponded with the maximum of the ionization.

The potential gradient runs exactly opposite to the dissipation, as though there were a constant charge of negative electricity being given to the surface of the earth during the whole year, while the amount at any moment on the surface, measured of course by the potential gradient, is determined by the rate at which the charge is being dissipated. How this charge is supplied to the earth still remains, in spite of many theories, one of the unsolved problems of atmospheric electricity. * * * My observations do not show that great increase in dissipation that has been ascribed to high latitudes by some writers. * * *

[With regard to atmospheric radio-activity Mr. Simpson says:]

In 1901 Elster and Geitel[6] made the very important discovery that the atmosphere always contains more or less radioactive emanation. Since this discovery several workers have repeated the observations and confirmed the results. During the whole of 1902 Elster and Geitel[7] made daily observations of the radio-activity, and found that the amount of emanation in the atmosphere depends largely on some meteorological conditions, such as the rising or falling of the barometer and temperature; and, as a result of their work, they made the suggestion that the emanation in the air is supplied entirely by the radium or radio-active emanation contained in the soil.

The method used by Elster and Geitel to detect and measure the emanation in the air, which has been adopted by other observers, consisted of stretching a wire about ten meters long between insulators in the open air. This wire was then charged to a negative potential of between 2000 and 2500 volts. After the wire had been exposed to the air at this potential for two hours, it was removed and wrapped round a net cylinder fitting inside the "protection cylinder" attached to their dissipation apparatus (specially closed at the bottom as well as the top for this measurement), and the rate at which the electroscope discharged was determined. When one meter of the wire discharged the electroscope one volt in one hour, the atmospheric activity was said to be unity and written $A=1$.

Using Elster and Geitel's method, I made observations of the atmospheric radio-activity in Karasjok.

* * * * * * *

As each observation occupied over two hours I made three observations daily for a month; * * * for one week out of the four I continued observations during the night; this was done for each alternate month, and gave a good idea of the annual and diurnal courses of the radio-activity. * * *

The radio-activity is constant and very high from September to February, inclusive. A maximum falls in midwinter and a minimum in midsummer. A diurnal maximum occurs in the early hours of the morning, and a minimum about midday. * * * Temperature plays a secondary part in determining the amount of activity in the air. Relative humidity appears to have a very large effect [the activity increasing with relative humidity]. The wind strength has a most direct influence [the greatest activity occurring with feeblest wind]. The radio-activity is greater with a falling than with a rising barometer. It is also greater with a low than with a high barometer in some months, especially April, May, and June, but no relation appears for the year considered as a whole. The influence of cloudiness is not clearly shown. The direction of the wind appears to give a maximum with a south wind, and a minimum with a north wind, but this may be only a restatement of the relation between activity and a rising or falling barometer. No relation between radio-activity and potential gradient can be detected, either in the separate months or in the whole year. * * *

This analysis gives an exceedingly strong support to Elster and Geitel's theory of the origin of the atmospheric radioactive emanation. According to their theory, the air which is mixed up with the soil of the ground becomes highly charged with radium emanation.[8] When the barometer falls, this air passes out of the ground into the atmosphere, bringing with it its charge of emanation.

All the facts of the above analysis receive a very simple explanation by this theory if one extends it to include the fact that, as the emanation is a gas contained in the soil, it must constantly diffuse into the atmosphere above quite independently of the state of the barometer. Assuming this constant diffusion we at once see that whatever tends to reduce the atmospheric circulation, namely, to keep the air stagnant, tends also to increase the quantity of emanation in the lower layers of the atmosphere. * * *

One strange fact is that the radio-activity should be so high during the winter when the whole country is covered with snow * * * but the reason is not hard to find if it be remembered that the snow must form a very large reservoir to hold the emanation as it is escaping from the soil. It would be interesting to see if air drawn from the snow in the way Elster and Geitel drew it from the ground is charged with emanation. * * *

Elster and Geitel concluded that the radio-activity increased from the sea inland. In order to find if the same conditions hold true in the north I stayed in Hammerfest on my way home and made daily observations for four weeks. The result was in entire agreement with Elster and Geitel, and these observations also showed the great variation of radio-activity with the direction of the wind. * * *

During my year in Karasjok there were not many exceptionally fine auroras, and colored auroras were very rare. From the one or two I did see the colors appeared to be of two distinct kinds (by colors in this connection I mean colors other than the greenish-white light of the ordinary aurora.) There is first the mass of colored light which retains its form and

[6] Phys. Zeit., 1901, vol. 2, p. 590. [7] Phys. Zeit., 1903, vol. 4, p. 526.

[8] Phys. Zeit., 1904, vol. 5, p. 11; Terr. Mag., 1904, vol. 9, p. 49.

color for a comparatively long time, and beside this the colors which flash out and disappear immediately. A very interesting fact struck me with regard to the latter class. It is generally known that an auroral arch is often composed of a series of spear-like shafts of light arranged perpendicularly to the direction of the arch, which appear to be in constant motion. A number of these spears will suddenly become brilliant and the lower ends shoot out of the arch into the black sky below. The brilliancy will then run along the arch like a wave of light, lighting up all the spears as it goes along. I noticed that the "front" of such a wave of brilliancy and the points of the spears *when shooting out* were bright red, but as soon as the motion stopped the color disappeared, while the more violent the motion the purer and brighter the red. It appeared as if some physical process accompanied the passage of the auroral beam through the air and gave out a red light. For example, if the air had to be ionized before the discharge could pass through, then the process of ionization produced red light. If the motion was particularly violent, the production of red light would be followed by a production of brilliant green light, so that if a bright wave passed along an arch two waves of color would appear to travel along, first a wave of red light, closely followed by a green wave, the two traveling so closely together as to appear as one wave having a two-colored crest. Similarly spears shooting out with a great velocity would appear to have red and green tips.

The question of the relation of clouds to auroras has been very often raised. Three of my observations bear on this point.

On the evening of October 11, 1903, after a fairly active display, the aurora disappeared; but its place was taken by a system of narrow bands of cirrus clouds stretching right across the sky, which, being illuminated by the bright moon, had all the appearance of the aurora. That they did not form part of the aurora could only be decided at first owing to no line appearing in the spectroscope when pointed at them; but later there could be no doubt, as they partly obscured the moon.

On October 26 a very similar phenomenon again appeared; that which at first was taken to be aurora, later turned out to be cloud.

On December 13 the most brilliant auroral display of my stay took place. The whole display reached a climax at 9:45, when a most brilliantly colored corona shot out from the zenith. While this final brilliant display was taking place the sky suddenly became thinly overcast, and the aurora was only visible later as bright patches through the clouds.

It has long been a matter of controversy as to whether the aurora ever extends into the lower legions of the atmosphere. Several observers positively affirm that they have seen it quite close to the ground. This may be due to an optical illusion. One evening I was, for a considerable time, in doubt as to whether the aurora was really under the clouds or not. All over the sky were detached clouds, the clouds being of about the same size and shape as the spaces between them. Right across the sky a long narrow auroral beam stretched, showing bright and dark patches owing to the clouds. It looked exactly as if the auroral beam ran along under the clouds brightly illuminating the patches of cloud which it met. In reality the bright patches were the openings and not the clouds. It took me a long time to make quite certain of this, and it was only by at last seeing a star in the middle of a bright patch that I could be quite certain.

Lemström strongly supported the idea that the aurora often penetrates down to the earth's surface, and described how on one occasion the auroral line appeared in a spectroscope pointed at a black cloth only one or two meters away. I was able to repeat this observation on several occasions, and found that the line which then appeared in the spectroscope was not due to an auroral discharge in the air between the spectroscope and the black cloth, but was due to reflected light, which it was impossible to prevent entering the spectroscope, as the whole landscape was lit up with the monochromatic light of the aurora.

All the time I observed the aurora I could not detect the slightest noise accompanying the discharge.

THE TIME OF MOONRISE AND MOONSET.[1]

By WM. F. RIGGE, S. J., Creighton University, Omaha, Nebr.

On account of the moon's rapid motion both in right ascension and in declination, the computation of the times of the moon's rising and setting is apt to prove very laborious, since it can not be done except by successive approximations. The object of this article is to explain a very rapid method to be used for this purpose. While it may be an old one, the writer's reason for presenting it is that he has never found it in print.

The method to be described is a graphic one and requires in advance the construction of three diagrams, which we may denote A, B, and C. In order to show their practical use, they have been prepared for Omaha, Nebr. The problem before us, therefore, is to find the central [standard] times of moonrise and moonset at Omaha.

1. The first thing to be done is to find the time of the moon's meridian passage. This is given for Greenwich on page IV of every month in the American Ephemeris.[2] To reduce it to Omaha and to central time, we must add to it 6.4 (the Greenwich longitude of Omaha being $+ 6^h 23.8^m$) times the hourly difference there given, plus 23.8 minutes. This is done rapidly by means of diagram A, whose construction needs no explanation. Thus for January 13, 1906, when the time of the moon's transit over the meridian of Greenwich is $14^h 58.4^m$ and the hourly difference is 2.13^m, we find that 2.13 on diagram A indicates something over 37 minutes, which added to the Greenwich time gives $15^h 36^m$ as the central time of the moon's transit at Omaha.

2. The next step is to find the moon's hour angle. This is shown on diagram B for Omaha, the latitude being $+ 41° 16'$. The formula

$$\cos \tau = - \tan \varphi \tan \delta$$

gives the true hour angle, which must be corrected for refraction and parallax. For purpose of prediction it is evident that only the mean refraction or 36′ can be taken. Special computation will show that this diminishes the hour angle by 3.1^m for all values of δ between plus and minus 30°. For the parallax the mean value of 57.6′

[1] Many of the Weather Bureau observers, when called into court to testify as to the state of the weather at a given time, are asked whether the moon had risen, and they have, therefore, requested the Central Office to furnish them with tables of moonrise and moonset. As such tables, in order to be at all accurate, must be computed for each locality, it is proper that the work should be done by the astronomers of the Nautical Almanac. But this is not always practicable and the tables given in the ordinary popular almanacs are not sufficiently accurate or extensive. A graphic method has just been published by Rev. W. F. Rigge, of Creighton University, Omaha, Nebr., (see Popular Astronomy, Vol. XIII, No. 10). This will enable any one to compute the times of rising and setting for a whole month or year in a short time, utilizing the data given in the Nautical Almanac. We, therefore, reprint the following article by Professor Rigge, in the conviction that many of our readers will make use of his method.—EDITOR.

[2] Page IV of the American Ephemeris and Nautical Almanac gives the following items in Greenwich mean time:

(1) The semidiameter of the moon at Greenwich mean noon and (2) at midnight.

(3) The horizontal parallax of the moon for Greenwich mean noon and (4) mean midnight, with (5) and (6) the rate of change of each in one hour.

(7) The Greenwich mean time of the upper transit of the moon's center across the meridian of Greenwich, and (8) the rate of change of this time for an hour, whence the time of transit over any other meridian can be computed.

(9) Finally the age of the moon at Greenwich mean noon, counting from the moment of conjunction with the sun.

The following are the figures for January 13, 1906:

(1) 15′ 44.9″, (2) 15′ 48.4″, (3) 57′ 42.0″, (4) 57′ 54.9″, (5) +1.11″, (6) +1.05″, (7) $14^h 58.4^m$, (8) 2.13^m, (9) 18.3 days.

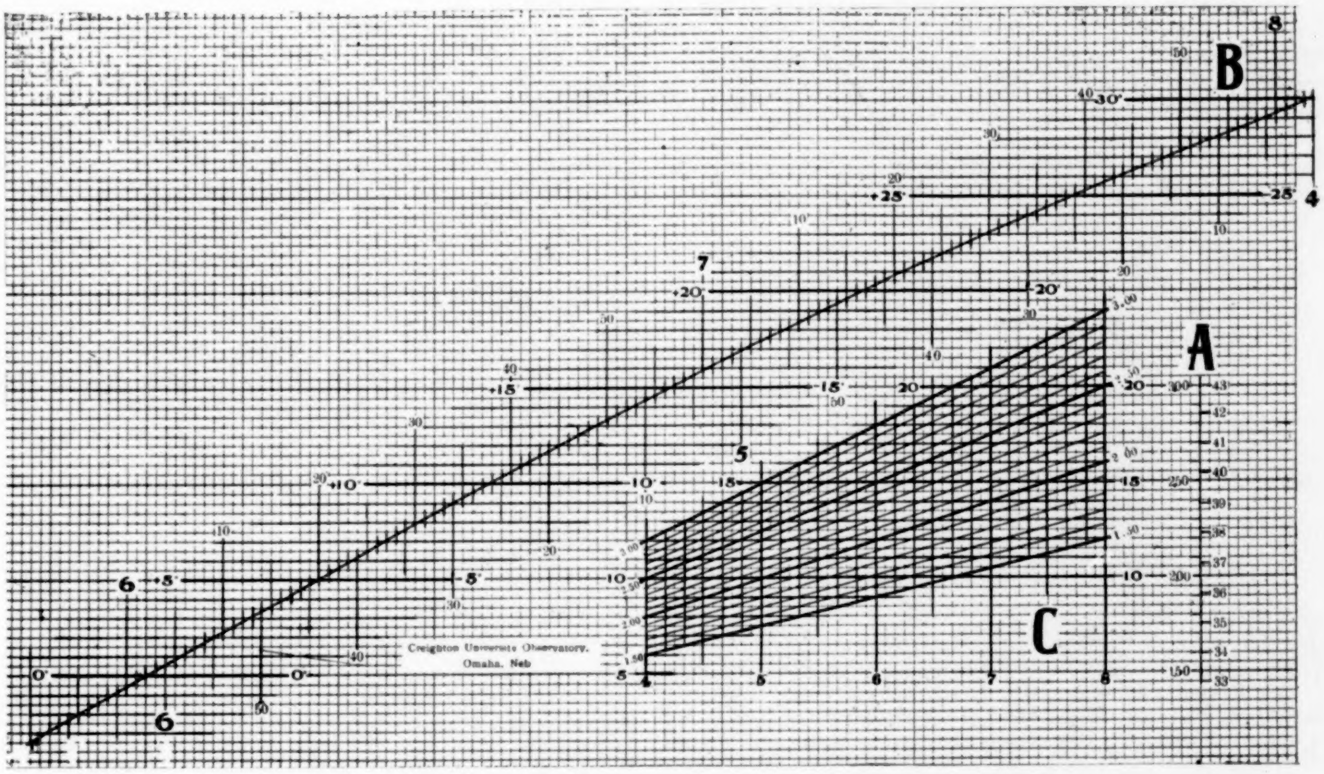

FIG. 1.—Rigge's method of finding the time of moonrise and moonset.

may always be used, since the extreme values differ only 3.7′ from it or less than one-fifteenth of its amount. As the parallax increases the hour angle while refraction diminishes it, the combined effect of both is to increase the moon's hour angle by two minutes. Accordingly all the hour angles on diagram B have been increased by this amount. No variations from the mean values of the refraction and parallax, used in the construction of this diagram, can ever change the hour angle one-third of a minute. No correction for semidiameter has been applied. This would diminish every hour angle at Omaha a minute and a half for the upper limb, or increase it as much for the lower. [Hence the computed times refer to the center of the moon.—EDITOR.]

Entering the Ephemeris[3] on pages V–XII of the month with the central time of the moon's meridian passage at Omaha increased by six hours (that is, the Greenwich time, $15^h 36^m + 6^h = 21^h 36^m$), on January 13, 1906, we find the moon's declination to be about $9\frac{3}{4}°$ north. I say "about," because at this stage the fraction of a degree is of no importance. With this argument of $9\frac{3}{4}°$ north, we find that on diagram B the moon's approximate hour angle is $6^h 37^m$. This is written under the time of the moon's transit, $15^h 36^m$, and then subtracted for rising but added for setting. With the results, $8^h 59^m$ and $22^h 13^m$, increased by six hours (to obtain the Greenwich times, $14^h 59^m$ and $28^h 13^m$) we make a second approximation and apply to the diagram the moon's declination at these times as found in the Ephemeris. We write down under $8^h 59^m$ and $22^h 13^m$ only the difference between the first and the second hour angles found on diagram B, viz, -4^m and -4^m in the present instance. Experience will soon show what fraction of a degree of the moon's declination it is necessary to take in order to get the hour angle correct to the minute. If any care at all has been taken about the first value of the moon's declination, the corrections -4^m and -4^m to the first approximate hour angle will agree numerically within two minutes, and will have the same sign, which will be plus when the moon is going north and minus when going south.

3. The third step is to correct the time of the moon's rising and setting for its motion in right ascension. This is done by means of diagram C, which is merely a graphic method of multiplication. The vertical lines marked 4, 5, 6, 7, 8, indicate the moon's hour angles, and the oblique ones 1.50, 2.00, 2.50, 3.00, the hourly difference of the times of the moon's meridian passage as given on page IV of the month in the Ephemeris. With these two as arguments, viz, $6^h 37^m$ and 2.13^m in the example selected, we find from the horizontal lines marked 5, 10, 15, 20, the correction sought, which here is fourteen minutes. This is to be subtracted for rising and added for setting, and is the same numerically for both.

As the correction given by diagram C may amount at times to twenty minutes and more, a third approximation would seem to be necessary. In declination this is inappreciable, since the maximum change of the moon's declination is less than one-third of a degree in an hour, and in twenty minutes it would never affect the moon's hour angle on diagram B to a noticeable fraction of a minute. In right ascension, however, a first correction of twenty minutes when added to the hour angle that was used to find it by means of diagram C would entail a second correction of a full minute if the hourly difference were 3.00, a limit which it never reaches. But as this second correction often exceeds half a minute, the hour angle may at once be increased by the amount of the first correction and another found from the diagram. It would not be advisable to reconstruct diagram C for the purpose of avoiding this additional labor, since, as will be said later, this error affects only the time of the moon's setting at Omaha, and never that of its rising.

4. Adding up our quantities algebraically, we obtain $8^h 41^m$ and $22^h 23^m$ as the astronomical central [standard] times of the moon's rising and setting at Omaha on January 13. Changing these to civil central [standard] times, we find that the moon

[3] Pages V–XII of the Ephemeris give the right ascension and declination of the moon for each hour of Greenwich mean time, astronomical reckoning, in which the zero hour corresponds to noon of the civil day of the same date.

rises on January 13 at 8:41 p. m. and sets on January 14, at 10:23 a. m. A day will be found to drop out for rising as well as for setting whenever the time changes from p. m. to a. m., viz, when it crosses midnight.

January 13, 1906.

Rising.	Setting.	
$15^h\ 36^m$	$15^h\ 36^m$	Meridian passage, central time, by A.
$-6\ 37$	$+6\ 37$	Approximate hour angle, by B.
8 59	22 13	Approximate times.
-4	-4	Correction for change of declination, by B.
-14	$+14$	Correction for change of right ascension, by C.
8 41	22 23	Astronomical central [standard] times.
13^d 8:41 p. m.	14^d 10:23 a. m.	Civil central [standard] times.
$8^h\ 40^m\ 39^s$	$10^h\ 21^m\ 59^s$	Numerical computation as check.

Accuracy.—The diagrams, especially A and C, may be used to tenths of a minute, if desired. But the nearest whole minute is sufficiently accurate in practise, since often the horizon is obstructed by terrestrial objects or dimmed by smoke, or the weather is unpropitious, and most of the times of moonrise and moonset occur during the daytime or at inconvenient hours during the night, so that only such a small percentage of the computed times are actually observed that more accurate and time-consuming computation would seem to be only so much labor wasted. As three diagrams are used, and the nearest minute is taken in each one, it may happen that in each case nearly half a minute is neglected always in the same direction, and, therefore, the results may be erroneous by more than a full minute. This is certainly possible and must occur at times, but it is just as likely that these fractions of a minute may have contrary signs and annul one another.

No account need ever be taken of second differences in the times of the moon's meridian passage. For Omaha the moon always rises within two hours and a quarter of its upper transit at Greenwich, so that the errors of these diagrams A and C counteract one another. But as the time of the moon's setting occurs within two hours and a quarter of the moon's lower transit the errors of these diagrams are additive. An examination of the Ephemeris of 1894, when the moon's ascending node was near the vernal equinox and the moon, therefore, reached a declination of over 28°, showed the maximum second difference between two successive days to be 0.24 minute. For an interval as great as sixteen hours from the time of the moon's upper transit at Greenwich, only one-third of this, or 0.08, would be effective, and this amount for the maximum hour angle (eight hours) would be only about 1.2 minute. As this is a most exceptional case, it is safe to say that, in general, this method is accurate enough to give the times within a minute. This estimate was confirmed by a more rigorous numerical computation of this same example of January 13, 1906, which was selected at random, and in which the moon's right ascension and declination, the sidereal time, and other necessary quantities were used and the same result was obtained practically within a minute.

Speed.—The speed is such that I generally compute the times of both rising and setting for a whole month in less than an hour, and sometimes even in less than 45 minutes.

A POSSIBLE EXTENSION OF THE PERIOD OF WEATHER FORECASTS.

By E. B. GARRIOTT, Professor of Meteorology. Dated February 15, 1906.

Periods of excessive heat or cold, and of drought or stress of rain, are invariably associated with marked irregularities in the location and movement or in the character and intensity of the great continental and oceanic areas of high and low barometric pressure. During periods of abnormal heat or drought in any part of the Northern Hemisphere, there is an undue and stagnated accumulation of air in and about one of the great anticyclonic areas, and a corresponding deficiency in and about one of the great cyclonic areas. Periods of cold or of excessive precipitation are due either to (1) abnormally rapid changes in the greater atmospheric areas, whereby a rapid progression of the lesser areas of high and low barometer produces a succession of cold waves and rains, or to (2) a persistent abnormal distribution or development of one or more of the greater areas whereby existing conditions of cold, or of wet, are prolonged. It is also true that abnormalities of weather over some portions of the globe, or of the Northern Hemisphere, are counterbalanced by opposite tendencies over other portions. Thus months that are exceptionally warm or cold, wet or dry, over the United States east of the Rocky Mountains have similar characteristics over Europe and at least a part of western Asia, and exhibit opposite tendencies over the United States west of the Rocky Mountains and over southeastern Asia. An explanation of this fact is found in a study of the greater areas of high and low barometric pressure or "centers of action" of the Northern Hemisphere.

These "centers of action" appear to control the character and movements of the areas of high and low barometer that appear on our daily weather maps, and in efforts to coordinate the causes that contribute to produce weather effects in the hemisphere as a whole or in any of its parts, all causes are important and none can be neglected. Professor Hann has found that pressure changes in the Azores high area and the Iceland low area are interrelated and of an opposite character, and that these changes are associated with certain phases of weather in central and northwestern Europe. He has discovered that rising barometer over the Azores is usually attended by falling barometer over Iceland, and, *vice versa*, that falling barometer in the Azores high area is attended by rising barometer in the Iceland low area. Also that falling barometer in the Iceland area produces warmer weather over central and northwestern Europe, and that rising barometer over Iceland is followed by falling temperature over northwestern Europe. It appears, therefore, that marked changes in the Azores high area, regarding which advices are cabled daily, afford an index of the character of the weather that will prevail for several days over a considerable portion of Europe.

A merely preliminary and general consideration of the whole problem places the dominating centers of atmospheric action of the Northern Hemisphere over Siberia and Bering Sea, and an examination of these areas presents an interrelation similar to that noted for the north Atlantic high and low areas. It has been observed, furthermore, that the effects of changes in the Asiatic high and the Bering Sea low are vastly greater and more widespread than those that may be associated with the north Atlantic areas, and that when pressure abnormalities within and about the Asiatic-Bering centers of action are marked, persistent and well-defined types of abnormal weather are experienced throughout the circuit of the Northern Hemisphere.

Among well-remembered abnormal seasons, or parts of seasons, when the influence of the dominating "centers of atmospheric action" was conspicuous, were the mild months of the winters of 1889–90 and 1905–6, and the cold months of the winters of 1903–4 and 1904–5. The months of the winters of 1889–90 and 1905–6 that were warm over great portions of the United States and Europe showed an unusual depression in the Bering Sea low area. The deepened Bering Sea area extended and overlapped the northwestern part of North America, and offshoots therefrom moved eastward in abnormally high latitudes. The resultant abnormal depression of the barometer over northwestern British America caused an unusual prevalence of southerly winds over northern portions of the United States and apparently prevented the formation of the areas of high barometer over British America that are essential to the origin and propagation of American cold waves.

It has also been evident that during periods of abnormal depression in the Bering Sea low area, the Pacific area of high barometer increases in mass and overlaps the southwestern coasts of the United States, producing over a greater or less portion of the region lying west of the Rocky Mountains temperatures below the seasonal average. The warmer weather over central and northwestern Europe that is usually associated with excesses in winter temperature in North America, appears to be in a great measure due to an increase in the magnitude of the Asiatic high area that attends an abnormal depression in the Bering Sea low area. At such times an unusually steep barometric gradient from Asia over Europe, and an increase in the Atlantic high area, cause an undue prevalence of warm southerly winds over central and northwestern Europe, and, coincidently, the augmented Siberian high area causes a sweep of cold north or northwest winds over southeastern Asia.

During the cold months of 1903-4 and 1904-5 an entirely dissimilar distribution of pressure in the great "centers of action" obtained. Pressure was unusually high in the Bering Sea and Iceland low areas, and the magnitude, or extent, of the Asiatic high area was vastly less than during the winters of 1889-90 and 1905-6. The Pacific high area did not impinge on the California coast, and the Azores high area was inconspicuous and unpermanent. The northwestern portion of the American Continent was not subjected to the influence of abnormally low pressure off its western coast and British America therefore became the seat of an area of high barometer from which cold waves were drawn southward in the wake of areas of low barometer that traversed the United States. The absence of the Pacific high area seemed also to contribute to a more southern origin of American storms, and to undue barometric depression and precipitation over the southwestern portion of the country. In Europe, where the winters of 1903-4 and 1904-5 were also cold we look first for the Iceland low area, and find instead pressure much above the normal in that region; the Azores high does not exist in a permanent form. The Asiatic high occupies about one-half the area that marks its limits during the warm seasons in Europe and America. The effect of this abnormal distribution of pressure over Asia and Europe is to cause an unusual prevalence of northwest winds over a greater part of Europe, and to lessen the force of winds blowing from the interior of Asia over the southeastern portions of that Continent.

The above general presentation of a few facts regarding the influence on climate and weather of the dominating "centers of atmospheric action" of the Northern Hemisphere opens or reopens the problem of so-called long-range weather forecasts. Admitting the competency of the evidence submitted regarding the influence upon general weather conditions of abnormal phases of the great centers of high and low barometric pressure, the conclusion follows that a knowledge of the development of these phases would permit legitimate calculations of the results of which they are known to be the associated contributory causes. That changes in the greater areas are consummated with extreme deliberation is a recognized fact. The fact is also presented that these changes can to some extent be followed day by day with present telegraphic facilities. Cablegrams are now available from the seat of the Siberian winter high area and from the Azores region. They will in the near future be available from Iceland and the Alaskan coast, and it will be feasible to transmit them by wireless messages, either from islands of the Aleutian chain, or from vessels taking the Great Circle route across the Pacific. With this information daily available forecasts can undoubtedly be made of the general character of the weather for at least one week in advance. Such general forecasts could specify the character, whether warm or cold, wet or dry, of the weather of the near future, and could indicate the duration and termination, days in advance, of periods of abnormal weather.

Summarized in a general way, the indications afforded for the United States would be about as follows:

Barometer rising and above the normal in the Asiatic high area and falling and below the normal in the Bering Sea low area, and, incidentally, rising over the Azores and falling over Iceland, indicate a period of mild weather over northern and eastern districts of the country.

Barometer falling and below the normal in Asia and rising and above the normal over Bering Sea, and, incidentally, falling over the Azores and rising over Iceland, indicate a period of cold weather over the country generally east of the Rocky Mountains.

The above are but two indications of the many that are afforded by a study of the great "centers of action." Others equally applicable are available for all of the seasons and possess an equal degree of merit.

The main "center of action" in the winter season is the Asiatic area of high pressure, and the character and movements of this great mass appear to control in a measure not only the interrelated actions of the lesser "centers of action," but also periods of weather that persist for days, and the character and movements of areas of high and low barometer that cause the daily changes shown on our weather maps. Furthermore it is believed that a study of the Asiatic high, and the employment of telegraphic reports from the region it occupies, will permit accurate forecasts of the monsoons in southern and southeastern Asia.

FORECASTS AND VERIFICATIONS IN WESTERN AUSTRALIA.

By W. Ernest Cooke, Government Astronomer. Dated Perth, W. A., January 8, 1906.

From the commencement of 1905 I have adopted a new method in connection with the issue of weather forecasts, and the following statement will probably interest some of your readers.

All those whose duty it is to issue regular daily forecasts know that there are times when they feel very confident and other times when they are doubtful as to the coming weather. It seems to me that the condition of confidence or otherwise forms a very important part of the prediction, and ought to find expression. It is not fair to the forecaster that equal weight should be assigned to all his predictions and the usual method tends to retard that public confidence which all practical meteorologists desire to foster. It is more scientific and honest to be allowed occasionally to say "I feel very doubtful about the weather for to-morrow, but to the best of my belief it will be so-and-so;" and it must be satisfactory to the official and useful to the public if one is allowed occasionally to say "It is practically certain that the weather will be so-and-so to-morrow."

With a view of expressing various states of doubt or certainty, as simply as possible, I now assign weights to each item of the forecast. The signification of the weights was stated as follows, with their first issue:

5. We may rely upon this with almost absolute certainty.
4. We may rely upon this with tolerable certainty, but may be wrong about once in ten times.
3. Very doubtful. More likely right than wrong, but probably wrong about four times out of ten.
2. Just possible, but not likely. If showers are indicated, for example, they will not be heavy even if they occur at all.
1. The barest possibility. Not at all likely.

In order to familiarize the public with the new departure a number of these explanatory slips were printed and attached to the forecasts wherever they were publicly exhibited. Thus a forecast might read as follows:

Southwest district (Geraldton to Esperance.) Fine weather throughout (5) except in the extreme southwest where a few light coastal showers are possible (2). Warm or sultry for the

present inland (4), but a cool change is expected on the west and southwest coast (4), which will gradually extend throughout (4).

The figures (1) and (2) are very seldom used, and then only as above, to indicate just a bare possibility. The figure (3) is occasionally employed for the main forecast, but the general practise is to use either (4) or (5) for the principal weather feature whenever possible, and this has been found practicable on most days. Whenever there is any serious doubt the figure (3) is used.

Great care is taken as to the figure (5). We wish to establish the utmost confidence in predictions followed by this figure and are therefore inclined to be rather conservative in its use. It has, however, been found possible to issue 685 such confident predictions for the two principal districts during the year, and of these 675 were justified by subsequent events.

As our weather comes mainly from the westward, where there are no observing stations, the period for which the prediction is issued is limited to 24 hours.

Two forecasts are issued daily (except Saturday and Sunday) for the Southwest and Goldfields districts, and the following shows the success or otherwise of the new system.

	Southwest district.			Goldfields district.	
	Right.	Wrong.		Right.	Wrong.
Weight 5	435	5	Weight 5	240	5
Weight 4	573	38	Weight 4	337	22
Weight 3	131	38	Weight 3	102	25
Weight 2	24	18	Weight 2	13	11
Weight 1	6	5	Weight 1	5	3

NOTE BY PROF. E. B. GARRIOTT.

For the limited areas covered by our forecasts by States this scheme would be impracticable, (1) for telegraphing our forecasts, owing in part to the great number of words and consequent expense that would be involved in transmitting them; (2) for forecast cards, that would not contain them; (3) for maps, that have not sufficient space to print them; (4) for the reason that the bewildering complication of uncertainties it involves would confuse even the patient interpolator; and (5) because our public insist upon having our forecasts expressed concisely and in unequivocal terms. For general forecasts, that apply to the country as a whole, our present vocabulary can, if properly employed, be made to cover all necessary modifications.

THE RELATION OF FORESTS TO RAINFALL.[1]

By the late W. F. HUBBARD.

[Communicated by Mr. Geo. B. Sudworth, Chief of the Division of Dendrology.]

The relation between forests and rainfall is very complex. It is claimed that the presence or absence of forests may increase or diminish precipitation to some extent, especially in semiarid regions.

On the other hand, forests are dependent upon moisture, and, other things being equal, the densest forests are found in regions of greatest rainfall. It is not the total precipitation of the year that favors vegetation (field crops as well as forests), but the amount that falls during the growing season. Thus a locality may have thirty-five inches of rain annually, but if most of it falls in heavy showers or during the winter, some trees and crops will flourish less than where an annual average of but twenty inches is made up largely of moderate spring and summer rains. Trees are more dependent upon uniformity in the rainfall than the field crops, for if a severe drought comes but once in five years the trees may be killed. It is also true that a crop of grain may be destroyed by the drought, but that is a loss of only one season's growth whereas in the case of the trees it is a loss of the growth of many years. In general it is found that a region having less than fifteen inches of rain during the six growing months, April–September, does not support flourishing forests; trees may grow along the streams and where they are cultivated, but the real forest will be absent.

As rainfall determines the presence or absence of forests, so the configuration of the land and its relation to water bodies and constant winds determine the rainfall. These relations and their effects can be traced in all forest regions of the United States, but they are so clear in the western half of the country that that section may be taken as a type. It should be remembered that moisture is carried in the atmosphere, and that when an air current is forced to rise, as when it meets a mountain range, the air expands, is cooled, and precipitates its moisture first as cloud and then as rain. When a current descends, as from the crest of a mountain, the process is reversed; that is, the air is compressed, warmed, and made retentive of moisture or even capable of absorbing more water from any available source. The western coast line of the United States includes a great curve with the crown of the arc at Cape Mendocino. The rain bearing winds are the west or northwest winter winds. They are also much more constant over the northern half of the coast line than over the lower or southern half, since the latter falls within the region of subtropical calms. All these conditions combine to determine the character of the forests throughout the West and explain why they are dense on the Pacific coast, and on the western slopes of the Sierras and the Rocky Mountains, and why they dwindle on the eastern slopes and fail entirely on the plains.

The accompanying map and profile of California illustrate this subject very thoroughly, because every feature of forest distribution is to be found within this State. The westerly winds striking the Coast Range have their moisture condensed as fog in summer and rain or snow in winter; here are the heavy redwood forests. Passing the summit of this range the winds descend and become drier and drier, finally reaching the great interior valley where no trees grow. Then mounting the western slope of the Sierras the winds expand and cool and rain falls. The increase of moisture is marked by the transition from chaparral to open pine forests, then to denser forests of fir, spruce, sugar pine, and the great sequoia. The upper timber line is at about 10,000 feet; for various reasons no trees grow on the higher summits, but not because of deficient moisture. Passing the summits, the winds again descend to the plains, but they have lost so much of their moisture[2] in crossing two mountain ranges that on the

[1] This paper consists essentially of a large chart of California, showing in detail the distribution of rain and forests in that State. The chart and accompanying text were prepared by the late William F. Hubbard, of the Bureau of Forestry, for exhibition at the Lewis and Clark Exposition held at Portland, Oreg., in 1905. Unfortunately Mr. Hubbard was drowned on July 17, and the text must, therefore, be published without his final revision. The chart represents the work of a very enthusiastic student, and we regret that, owing to the limitation of our space, we are unable to publish the whole of the chart, which is based upon all available reliable data, and affords a basis for many generalizations that the author would doubtless have elaborated had his life been spared.

[2] The air does not lose much moisture in coming over the California mountains, probably not one per cent; but it does lose many per cent in relative humidity.

From another point of view, however, one may say that, on the windward side of our Coast and Sierras ranges, there are more clouds than on the leeward side, consequently the soil and roots do not become so hot at midday, and especially does foggy weather keep them cool; this coolness is quite as important to the growth of a forest as high relative humidity or abundance of rain. In fact if one follows along the course of any one of the belts of forest growth he will find it running over various elevations and rainfall areas in such a way as to show that these two are not alone the controlling factors.

It would increase the value of such charts of the distribution of forests if something could be added as to the species of trees characteristic of the forests. It seems hardly sufficient to say that a dense forest prevails in a certain rainfall region, but a light forest in another rainfall region. Is not the species of tree as important as the density of the forest?—EDITOR.

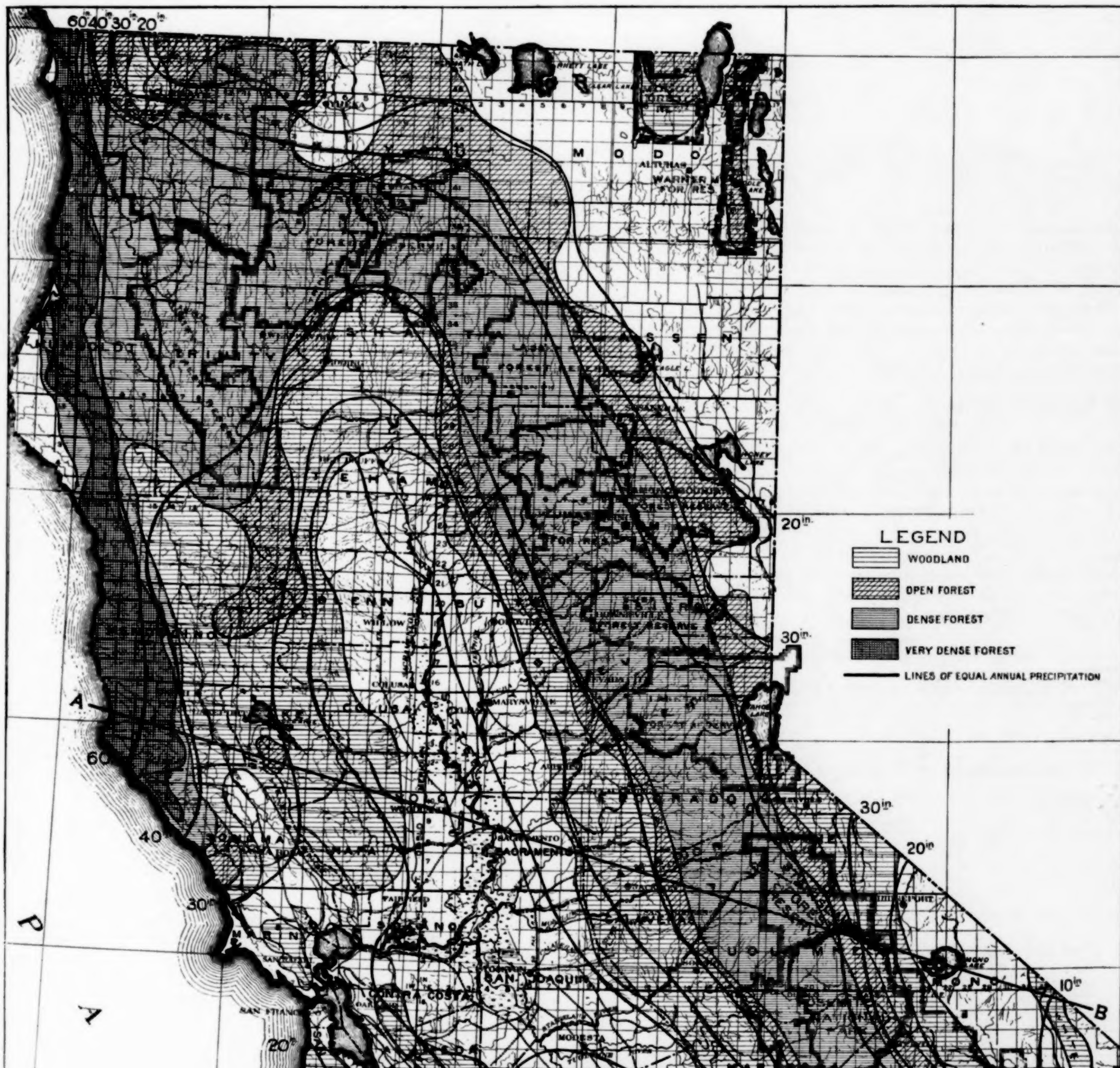

Fig. 1.—Distribution of annual rainfall and forests.

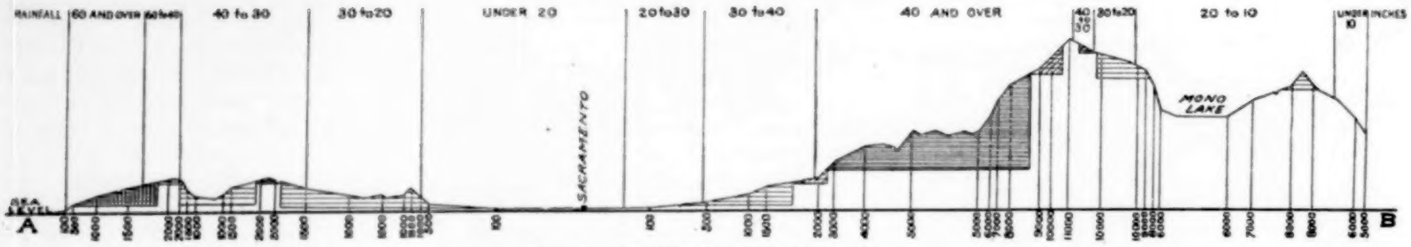

FIG. 2.—Profile along the line A B.

eastern slopes forests flourish for only a short distance below the 10,000-foot timber line. Then comes chaparral, and finally the desert. The latter extends far beyond the borders of California to the outlying ranges of the Rockies.

Thus topography and winds are the controlling factors in the distribution of forests. They make most of the Pacific coast a region of winter rains and summer droughts, and, away from the coast, limit the forests to the higher altitudes.

AN IMPORTANT OLD LOCAL WEATHER RECORD FOR PHILADELPHIA, PA.

Mr. John W. Dulles, President of the Insurance Company of the State of Pennsylvania, which was founded in 1794, states that the company has what appears to be a continuous and admirable record of the temperature, wind, and weather at Philadelphia, kept up for over 50 years, beginning with May, 1806. The following table is sent by Mr. Dulles as a sample page. Without having any further detailed information about this record, we need only call attention to the fact that whenever such records have been published in full, with appropriate notes and discussion, they have been recognized as important contributions to our knowledge of local climatology, and have often been made the basis of further studies relative to insurance, crops, hygiene, and other practical matters. The local climatology is a matter that interests respective cities and States, and there is no propriety in the idea that the Federal Government or the general Weather Bureau should undertake publications that have mostly a local interest. Two famous records of this kind were published by the Smithsonian Institution in order to show how such work should be done. Possibly some great work of the kind may be encouraged by the Carnegie Institution, but we ought more properly to look to the wealthy men of Philadelphia to support its own local scientific institutions, such as the famous American Philosophical Society, founded by Benjamin Franklin in 1744. This society has always shown a great interest in meteorology, and should be honored by the gift of funds for publishing and discussing such a fine, long series of records as that which is now locked up in the archives of the insurance company.

January, 1807.	Wind.			Weather.			Degrees of heat and cold.				Remarks.
	A. M.	M.	P. M.	A. M.	M.	P. M.	A. M.	M.	P. M.	Mean.	
							°	°	°	°	
1	n.	n.	s.	Clear	Clear	Clear	23	24	25½	24	Sharp frost.
2	sw.	sw.	sw.	Cloudy	Cloudy	Cloudy	26¼	28¼	30	28¼	Frost.
3	sw.	sw.	nw.	Fling clouds	Light clouds	Fling clouds	32½	33½	34½	33½	Last night rained a littel and froze this mornen, which rendered walken extremely dangerous.
4	sw.	sw.	sw.	Clear	Clear	Clear	32	33	34	33	
5	sw.	s.	sw.	...do	...do	Light clouds	34	35½	38¼	35¾	
6	sw.	w.	w.	Hazey	Fling clouds	Clear	41	42	42	41¾	
7	sw.	sw.	w.	Cloudy	Cloudy	...do	40	40½	41	40½	
8	w.	nw.	nw.	Clear	Fling clouds	Fling clouds	37	37	37½	37	
9	sw.	sw.	sw.	...do	Clear	Clear	33	33½	36	34	Frosty.
10	s.	s.	s.	Cloudy	Cloudy	Cloudy	33½	34½	36	34½	
11	sw.	w.	w.	...do	Fling clouds	Fling clouds	36	37	37½	36¾	
12	n.	nw.	nw.	Clear	Clear	Clear	35	34½	34½	34½	
13	nw.	nw.	nw.	Cloudy	Fling clouds	...do	28	27½	27	27½	Severe frost this day.
14	sw.	w.	w.	Clear	Clear	...do	23	23½	25½	24	Last night between 10 and 12 it blew a stiff galle from the W., the air very clear and cold; this morning the river shut, but opened agen in the afternoon.
15	sw.	sw.	sw.	Cloudy	Cloudy	Cloudy	32½	34	35½	34	
16	nw.	nw.	sw.	Fling clouds	Clear	Fling clouds	36	37	38½	37	
17	nw.	nw.	nw.	...do	Fling clouds	...do	32	32½	33	32½	
18	n.	n.	n.	Snow	Snowy	Snowy	32	32	31½	31¾	
19	nw.	nw.	w.	Clear	Clear	Clear	21	21½	23	21¾	
20	ssw.	sw.	sw.	...do	...do	...do	18½	19½	22½	20	
21	wnw.	nw.	nw.	...do	...do	...do	24½	26½	28	26½	Severe frost, with the navigation of the river shut.
22	nw.	nw.	nw.	...do	Hazey	...do	25½	26½	28	26¾	
23	ne.	ne.	se.	Cloudy	...do	Fling clouds	24½	25	27½	25¾	
24	sw.	nw.	nw.	...do	Cloudy	Cloudy	31	32½	34	32½	
25	w.	nw.	nw.	Clear	Fling clouds	Clear	31	31½	31	31½	
26	nw.	nw.	nw.	...do	Clear	...do	22	22	22½	22	
27	ne.	ne.	se.	Hazey	Hazey	Hazey	21	24	27½	24½	
28	s.	w.	se.	Cloudy	Cloudy	Clear	39	41	42½	40¾	Thaw.
29	sw.	w.	w.	Light clouds	Light clouds	...do	39½	41	42½	41	
30	ssw.	nw.	sw.	Clear	Clear	...do	39½	40	41½	40¾	
31	ne.	se.	s.	Rainy	Rainy	Rainy	39	40½	42	40½	This day very wet, afternoon very foggy and dense.

NOTE—Fling clouds = flying clouds.—EDITOR.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

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Proceedings of the fifty-fourth meeting, held at Philadelphia, Pa., December 27-31, 1904. 620 pp. 8°. [Washington] 1905.

Biot, [Jean Baptiste].
Recherches sur les réfractions extraordinaires qui ont lieu près de l'horizon. 268 pp. 4°. Paris. 1810.

Carnegie Institution of Washington.
Year Book. No. 4, 1905. 4°. Washington. 1905.

Clayden, Arthur W[illiam].
Cloud studies. xiii, 184 pp. 8°. London. 1905.

Costa Rica. Instituto Fisico-Geografico Nacional.
Anales. Tomo IX. 1896. f°. San José. 1896.

Gockel, A[lbert].
Das Gewitter. 264 pp. 8°. Köln. 1905.

Lausanne. Institut Agricole de Lausanne.

Observations météorologique faites à la Station météorologique du Champ-de-l'Air. 18 année, 1904. 4°. Lausanne. 1905.

Marchi, Luigi de.
Meteorologia generale. 2d edition. xiii, 225, 64 pp. 24° Milano. 1905.

Mont Blanc. Observatoire Météorologique Physique et Glaciaire du Mont Blanc.
Annales. Tome VI. vii, 218 pp. 4°. Paris. 1905.

Sassenfeld, Maximilian.
Zur Kenntnis der täglichen periode der Temperatur in der untersten Luftschicht. (In K. Kath. Gymnasium zu Sigmaringen. Jahresbericht. 1903–1904.) 41 pp. 8°. Sigmaringen. 1904.

Specola Vaticana.
Pubblicazioni. Volume VII. xxix, 222 pp. 4°. Roma. 1905.

Strutt, R[obert] J[ohn].
The Becquerel rays and the properties of radium. vi, 214 pp. 8°. London. 1904.

RECENT PAPERS BEARING ON METEOROLOGY.

H. H. KIMBALL, Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——

Aeronautical Journal. London. Vol. 10. Jan., 1906.
Bacon, Gertrude. The acoustical experiments carried out in balloons by the late Rev. J. M. Bacon. Pp. 5–6.

London, Edinburgh, and Dublin Philosophical Magazine. 6th Series. Vol. 11. Feb., 1906.
Stevenson, John. The chemical and geological history of the atmosphere. Pp. 226–237.
Russell, Alexander. The dielectric strength of air. Pp. 237–276.

Nature. London. Vol. 73. Jan. 25, 1906.
Wilks, Samuel. What causes the destructive effects of lightning? P. 296.

Physical Review. Lancaster. Vol. 22. Feb., 1906.
Barus, Carl. Condensation nuclei. Pp. 82–110.
—— Differential temperature records in meteorological work. [Abstract of paper by C. H. McLeod and H. T. Barnes.] Pp. 112–113.
Humphreys, W[illiam] J[ackson]. The Mount Weather Research Observatory. Pp. 127–128.

Popular Science Monthly. New York. Vol. 68. Feb., 1906.
Tamura, S. Tetsu. Recent advances in meteorology and meteorological service in Japan. Pp. 139–144.

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B[orns], H. Rain showers and a new method of rain measurement. [Abstract of article by W. Gallenkamp.] P. 7.
B[orns], H. General movements of the atmosphere in winter. [Abstract of article by P. Garrigou-Lagrange.] P. 7.
B[orns], H. Direct proofs of the existence of the counter-trades. [Abstract of article by A. L. Rotch and L. Teisserenc de Bort.] P. 8.

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McAdie, Alexander G. Mount Rainier, Mount Shasta, and Mount Whitney as sites for meteorological observatories. Pp. 7–14.

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Todd, Charles. Coldest spring on record in South Australia. Pp. 219–221.
Bonacina, L. C. W. On a scheme for the cooperative study of British thunderstorms. Pp. 221–226.

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Ebert, H. Luftelektrische Beobachtungen während der totalen Sonnenfinsternis 1905 August 30 in Palma de Mallorca. Pp. 165–176.
Messerschmitt, J. B. Bericht über die Internationale Conferenz für Erdmagnetismus mit Luftelectricität zu Innsbruck vom 9 bis 15 September 1905. Pp. 195–201.

Annuaire de la Société Météorologique de France. Paris. 53 année. Dec., 1905.
Moureaux, Th. Résumé de trente années d'observations météorologiques a l'Observatoire de Parc Saint-Maur (1874–1903). Pp. 265–276.
Maillet, Edmond. Sur les grandes crues de la Seine a Paris. Pp. 276–277.
Brunhes, B. and Baldit, A. Sur la dissymétrie de la déperdition électrique en pays de montagne; rôles comparés de l'altitude et du relief. Pp. 286–288.
Roger, E. Sur les variations de la moyenne des trois principaux éléments météorologiques (température, pression et pluie) du climat de Paris pendant le XIX siécle. Pp. 294–295.

Bulletin de la Société Belge d'Astronomie. Bruxelles. 11 année. Jan., 1906.
Durand-Gréville, E. La loi des grains et des orages. Pp. 4–13.
Guarini, E. Sur l'électricite atmosphérique. Pp. 13–23.
Vregille, Pierre de. La météorologie d'Alexandrie et de Beyrouth. Pp. 33–42.

Ciel et Terre. Bruxelles. 26 année. Jan., 1906.
P[rinz], W. La phosphorescence des éclairs. [Note.] P. 564.
—— De l'influence des pluies estivales sur le débit des sources de plaines. [Note on work by Lemoine and Belgrand.] Pp. 565–566.

Comptes Rendus de l'Académie des Sciences. Paris. Tome 142. 8 Jan., 1906.
Seux, Edmond. Sur la stabilité des aéroplanes et la construction rationnelle des plans sustentateurs. Pp. 79–81.

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Rudaux, Lucien. Mesure de la direction du vent. Pp. 109–110.

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B[racke], A. Anciennes dénominations de nuages. P. 4.
B[racke], A. Variation d'épassieur de brouillard pendant une journée. P. 5.

Annalen der Physik. Leipzig. 4 Folge. Band 19. 1906.
Schmidt, K. E. F. Bemerkungen zu der Notiz des Hrn. Walter: Ueber das Nachleuchten der Luft bei Blitzschlägen. Pp. 215–216.

Beiblätter zu den Annalen der Physik. Leipzig. Band 30. 1906.
A[ufsess], v. Beobachtungen über die Leuchtdauer der Blitze. [Abstract of article by K. E. F. Schmidt.] P. 63.

Gaea. Leipzig. 42 Jahrgang. Feb., 1906.
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AN APPEAL FOR AN AERO-PHYSICAL OBSERVATORY IN JAPAN.

By S. TETSU TAMURA, Ph. D. Dated Washington, D. C., March 9, 1906.

It is well known that the progress of meteorology has seemed very slow. Within the past century the world has seen electricity, chemistry, and other special branches of science emerge from their previous uncertain and indefinite condition, but dynamic meteorology is still wandering in fog and darkness. Thousands upon thousands of observations at the earth's surface have told us much, but still the fundamental mechanical problems have not yet been solved. Although the importance of the exploration of the upper atmosphere has been recognized ever since the days of Pascal, yet very little is known of this vast mysterious ocean of air. Meteorologists are now fully convinced that the atmospheric phenomena at the earth's surface depend, in great measure, upon the thermal and electrical as well as the dynamic conditions of the upper atmosphere. So long as this upper region remains unexplored meteorology will not only be unable to enter into the group of exact sciences but will fail to do its full service for the promotion of human welfare. Hence, a number of mountain observatories have been established in Europe and elsewhere and many balloon and kite ascensions have been made for sounding the depths of the upper atmosphere. The balloon ascensions of Gay Lussac and Biot in 1804, of Barral and Bixio in 1850, of Glaisher in 1862, and Berson in 1894 furnished many important facts relative to the physics of the atmosphere. Since this last date unmanned balloons, carrying only very light self-registering apparatus, have been brought to great perfection, and extreme heights of eleven or twelve miles have been reached that would otherwise have been inaccessible. By this mode of research Hermite, Besançon, and Teisserenc de Bort in France, and Assmann, Berson, and Hergesell in Germany, have done a great service to meteorology. Beginning with October, 1902, daily balloon and kite ascensions were made by Assmann and his associates at the Prussian Aeronautic Observatory, while Teisserenc de Bort's great work in his famous observatory at Trappes, near Paris, dates back to 1890.

The kite experiments in atmospheric electricity made in America by Benjamin Franklin in 1753, and by Joseph Henry in 1840, are now classic. Most important contributions to meteorology by kite flying have been made by Messrs. Rotch, Fergusson, and Clayton, of Blue Hill Observatory. The United States Weather Bureau in 1898 temporarily maintained seventeen kite stations, and is now completing the Mount Weather Research Observatory, where the temperature, moisture, and movement of the air at great heights will be ascertained by means of balloons and kites, while other researches on the sun's heat, atmospheric absorption, atmospheric electricity, terrestrial magnetism, and seismic phenomena will be conducted.

In Japan, too, the importance of the study of the upper air was recognized soon after the organization of our meteorological service in 1875. Since that time the specialists at the Central Meteorological Observatory at Tokyo and at provincial stations have undertaken many technical expeditions to high mountains in order to investigate the phenomena of the higher strata of the atmosphere. For the establishment of the first Japanese mountain observatory we are indebted to our illustrious Prince Yamashina. For the site of this observatory his imperial highness chose Mount Tsukuba, that remarkable mountain which stands alone on an extensive plain, and which, moreover, lies in the tracks of the cyclones of very intense character. Since its opening, in 1902, it has been of great service to observational meteorology in Japan.

It is evident, however, that the atmospheric data observed at mountain stations are very much affected by the local topography and the disturbing elements of the mountain mass and surface. A discussion of the observations made in the free upper air during balloon ascents from Munich, and those made simultaneously at neighboring mountain stations, shows important differences between them. Hence, it becomes vitally important for each civilized country or nation to establish on its own soil an aero-physical observatory, like those at Trappes, Blue Hill, Berlin, Lindenberg, and Mount Weather.

The scientific problems to be investigated at such a research observatory are manifold, and include the following:

(1) The distribution of temperature in the upper atmosphere; the thermal conditions in cyclones and anticyclones; the distribution and condensation of atmospheric moisture; the distribution of pressure in the upper and lower atmosphere: these are problems of paramount importance, and must be investigated by ascensions of balloons and kites.

(2) The absorption of solar heat by the atmosphere, which must be measured by means of the pyrheliometer and actinometer; the dissipation of solar light and heat as determined by the polariscope; the detailed analysis of the sunbeams as carried out by means of the bolometer and spectrometer. To all these there should be added apparatus for studying the conductivity and emissivity of the land and water, the snowfields and the forests of the earth's surface.

(3) The discovery of the remarkable properties of radium has opened up a field of research relative to the ionization of gases, and this has led to a complete revolution in our ideas relative to atmospheric electricity. By means of an Exner's electrometer and Benndorf's self-registering apparatus the potential should be measured. To make systematic observations of dissipation and radio-activity of the air under ground, we need the Elster and Geitel instruments. Corresponding measurements of the ionization should be made with the Ebert ion-counter, and the Gerdien conductivity apparatus.

Japan feels the direct influences of the Pacific Ocean and the Asiatic Continent, and also those of the tropical and polar ocean currents, so that meteorological as well as climatic conditions in Japan are very complex. Very often a continental cyclone, which appears to originate in the Asiatic Continent, and a typhoon, which comes from the Tropics by way of the Philippines and Formosa, pass over Japan simultaneously, bringing great complexities in the weather. In spite of all

these difficulties, however, the storm tracks and other meteorological conditions have been very carefully investigated by eminent Japanese meteorologists. Japan[1] has just established a new weather service in Korea and Manchuria, and is said to be intending to extend the service to southern China. These are all for immediate practical daily forecasts; but the exploration of the free upper atmosphere by balloons and kites has not been touched. This vast upper ocean of atmosphere, the study of which is exceedingly important for further advances in the physics of the atmosphere, as well as in the prediction of the weather, must remain entirely unknown to Japanese meteorologists until they are able to investigate it.

Japanese meteorologists do not generally possess all the expensive instruments and apparatus that are found in the United States and Europe. In the whole of Japan there is probably not a complete set of modern apparatus for the study of atmospheric electricity, such as those of Elster and Geitel, Ebert, Benndorf, or Gerdien. Japanese physicists and meteorologists have relied on their own hands and brains, but we have now come to the age when international cooperation in science is progressing rapidly and our scientists should be provided with laboratories and observatories containing powerful instruments and apparatus, It is sad, indeed, to hear from Japanese meteorologists that they have no hope of establishing an aero-physical observatory similar to those mentioned above.

I have been asked if I can induce some worthy American patron of science, or some institution, to establish an aero-physical observatory in Japan, or somewhere on the other side of the globe. What we should want at first would not necessarily be a great observatory, such as Mount Weather, but a small one, or several such, where we can observe with kites the conditions of the upper atmosphere, and can also study the atmospheric electrical phenomena by using the Ebert, Elster and Geitel, and Benndorf apparatus. Such work is entirely new in Japan, but good physical assistants and materials can be obtained at small cost. It will require only a few thousand dollars to establish such an observatory in Japan.

All Americans remember gratefully that the Smithsonian Institution, of Washington, which has done wonderful service for the increase and diffusion of scientific knowledge in America, was founded by a foreigner, an Englishman, James Smithson, in the beginning of the nineteenth century. May not Japan receive similar encouragement from foreign countries or institutions? Scientific research is becoming more and more international and cooperative; it soars far above the differences of race and national policy. The results of the meteorological investigations that are carried on in an aero-physical observatory in Japan will be directly beneficial to the whole human race as well as to that country. The world's meteorology will receive far greater benefits indirectly than will Japan directly. Our atmosphere must be studied as a unit. When the atmospheric conditions in the upper and lower strata become thoroughly known over America, Europe, and Asia, then, and only then, can meteorologists establish the true theories of cyclones, anticyclones, floods, and droughts on a firm observational basis. We must remember, however, that at present the atmospheric conditions in the upper atmosphere over the Eastern Hemisphere of the globe are entirely unknown, and the final solution of our complex aero-physical and dynamical problem is still far away.

All nations send their naval and merchant vessels to Japanese ports where we do our best to forewarn them of dangerous storms. A storm-warning service blesses all nations alike. Its signals represent an international cooperation for the benefit of all mankind.

[1] For the condition of the Japanese weather service, see "Recent advances in meteorology and meteorological service in Japan." Popular Science Monthly, February, 1906.

For these reasons I appeal confidently to the American patrons of science for the funds necessary to establish a modern aero-physical observatory in Japan.

WEATHER BUREAU MEN AS EDUCATORS.

Mr. Albert Ashenberger, Observer, Mobile, Ala., under date of January 20, reports that he delivered a lecture on weather forecasting before the faculty and students of Springhill College, Springhill, Ala. Special reference was made to the methods of long-range forecasters.

Mr. S. S. Bassler, Local Forecaster, Cincinnati, Ohio, reports that on December 15, 1905, he read a paper on "Weather proverbs and prophets" before the Ladies' Literary Club of Norwood, Ohio.

Mr. Al. Brand, Observer, Evansville, Ind., reports that about 30 members of the Men's Club of St. Paul's Church visited the Weather Bureau office on the evening of January 18, and listened to a talk by the observer on the instruments and work of the Bureau.

Mr. Frederick W. Brist, in charge of the office at Thomasville, Ga., under date of January 23, reports that on the 17th a class in physical geography from the Thomasville High School visited the office, and that its members were instructed in the construction and use of the various instruments and in the method of making forecasts from the daily weather maps.

Mr. Allen Buell, Observer, San Antonio, Tex., under date of January 31, 1906, reports that at various times during the school year he has given extemporary lectures to the pupils of the schools on meteorology in general and the methods and work of the Weather Bureau. Such lectures have been given in most of the higher schools in the city.

Mr. Norman B. Conger, Inspector, Detroit, Mich., under date of January 12, 1906, reports that the class in physical geography in the High School, 35 in number, visited the Weather Bureau office and listened to the usual informal talk on the instruments and work of the Weather Bureau.

Prof. H. J. Cox, Chicago, Ill., under date of January 16, 1906, reports that a popular lecture on "Weather and weather forecasting," illustrated with lantern slides, was given in Chicago as follows:

November 3, West End Woman's Club; November 16, Hyde Park Men's Club; November 21, Chicago Woman's Aid; December 1, Neighborhood Settlement, in Ogden Park Hall.

The Chicago Press Club visited the office November 14; an informal talk was given on instruments and forecasts.

Classes from schools have visited the office as follows:

October 19, Waller High School; October 20, Chicago Normal School; October 21, West Division High School; December 4, Oxford Preparatory School for Boys; December 8, Chicago Normal School.

Professor Cox reports, under date of January 30, that on January 26 he lectured at Michigan Military Academy, Orchard Lake, Mich., to an audience composed of faculty, students, and a few invited guests.

Mr. W. H. Fallon, Observer, Grand Haven, Mich., states that the class in physics of the local high school visited the office in sections on the 11th and 18th of December; the students were given instruction relative to the theory and use of the various meteorological instruments, the construction of weather maps, and other Weather Bureau work.

Mr. D. S. Landis, Assistant Observer, Fort Worth, Tex., under date of February 21, reports that on January 10 the class in physical geography from the Fort Worth High School, accompanied by the science teacher, visited the office, and was shown how the recording instruments work and how maps are made; also by a series of maps the development and progress of cyclones and anticyclones was followed. On January 23 Mr. Landis gave an illustrated talk on the weather, lasting half an hour, to the senior class of the Cleberne, Tex., High School.

Mr. G. A. Loveland, Section Director, Lincoln, Nebr., reports that on January 20 he delivered an address before the meeting of the Nebraska Association of Mutual Insurance Companies on "Electricity in the atmosphere."

Mr. H. W. Richardson, Local Forecaster, Duluth, Minn., reports under date of January 11 that about 25 members of the senior class of the State Normal School, Superior, Wis., visited the office, and were addressed on the subject of weather forecasting and the value of the Weather Bureau.

Mr. W. J. A. Schoppe, Assistant Observer, Iola, Kans., under date of January 29, reports that on the 17th and 18th the class in physical geography, and on the 22d the physics class of the Iola High School visited the Weather Bureau office, where the instruments, the weather map, and the general work of the Bureau were explained to them.

Mr. J. P. Slaughter, Section Director, Oklahoma, Okla., under date of January 7 reports that after moving into new quarters he will confer with the president of Oklahoma University in regard to the advisability of a course of instruction in meteorology.

Mr. J. Warren Smith, Section Director, Columbus, Ohio, under date of February 9, 1906, reports the following educational work done at that station during the month of January, 1906: January 4, regular lectures were begun at the Ohio State University at 4 p. m.; they are to be continued on Tuesdays and Thursdays at the same hour during the winter term of thirteen weeks. January 12, an illustrated lecture was delivered before the Boys' Club of the South Congregational Church at 7:30 p. m. January 25, his Ohio State University class of 40 men visited the Weather Bureau office and were given a lecture upon the instruments and general work. On January 26, 30, and 31 classes in physical geography of about 30 members each, from different city high schools, visited the office and were given a lecture on the instruments and general work of the Bureau.

Mr. P. H. Smyth, Local Forecaster, Cairo, Ill., reports that the class in physical geography of the Cairo High School visited the local office on January 10, 1906, and were given instruction in the use of instruments, preparation of maps, and methods of forecasting.

Mr. James H. Spencer, Observer, Dubuque, Iowa, under date of January 30, reports that on January 23 he gave an illustrated address on the weather map before the Fellowship Club of St. John's Episcopal Church of that city.

Mr. Chas. Stewart, Observer, Spokane, Wash., reports that on December 23, 1905, 20 pupils from Holmes Grammar School, accompanied by their teacher, visited the Weather Bureau office and had the meteorological instruments exhibited and explained to them. Similar visits were made on January 8 and 17, 1906, by parties from the class in physical geography of the Spokane High School.

Mr. W. P. Stewart, Assistant Observer, in charge of the office at Escanaba, Mich., under date of January 21, reports that on the 19th he delivered a lecture on the work of the Weather Bureau before the English Club of that city.

Mr. A. H. Thiessen, Section Director, Raleigh N. C., under date of January 29, reports that on January 25 the class in physics of the Baptist University at Raleigh visited the Weather Bureau office; that he gave them an informal lecture on instruments and the method of forecasting the weather; particular attention was given to the barometer.

Mr. J. R. Weeks, Observer, Binghamton, N. Y., under date of January 27, 1906, reports the delivery of the following lectures: November 16, 1905, at Public Library Lecture Hall, on "The weather in general;" November 17, 1905, at Western Presbyterian Church, to the Men's Club on "The weather;" November 23, 1905, at the Public Library, on "Special types of storms;" December 7, 1905, at the Public Library, on "Climate;" January 8 and 10, 1906, an informal talk to the physiography class of Binghamton High School, in two divisions, on "Instruments and work of the Bureau;" January 11, 1906, at First Presbyterian Church, to the Men's Club, on "Storms and weather forecasting." The formal lectures were all illustrated with stereopticon views.

Mr. Edward L. Wells, Observer, Boise, Idaho, reports that on January 19, the commercial geography class from the City High School, accompanied by their instructor, visited the Weather Bureau office, and that he gave them an informal talk upon the instruments, observations, and the principles underlying forecasting.

Mr. R. F. Young, Section Director, Helena, Mont., reports that he has begun a series of lessons to the physical geography class in the Helena High School. The course of instruction has been planned with special reference to the construction of the weather map and its use in forecasting weather and temperature.

TORNADOES—HAILSTONES—THUNDERCLOUDS.

Under date of June 12, 1905, Dr. J. P. Gibson, of Salisbury, Wake County, N. C., writes as follows:

TORNADO WINDS.

On April 5 last I had occasion to observe a severe tornado that struck this place about 4 p. m. on that day. It came from the southwest and lasted about seven or eight minutes, and the path of destruction was between 200 yards and three-fourths of a mile wide and about six miles in length. On the same evening there was a similar one about 25 miles west, at Mooresville, Iredell County, N. C., at about the same hour. A great many houses were partially and several totally demolished.

What I wish to call your attention to is as follows: There were two auditoriums—one 40 by 200 feet, the other 30 by 80 feet—and a church, 40 by 75 feet, in its path. The larger auditorium collapsed and lay flat on the ground; the end of the building facing the direction from which the storm came was in greater part blown inward and the other walls thrown outward. The large roof was lying flat between the walls on the seats and the ground; the building had no floor but the ground. The smaller auditorium had its roof entirely blown away toward the northwest, the end that fronted the south was blown in, and the other walls bulged outward, but did not fall to the ground. The third building or church utterly collapsed, the greater portion of the roof being blown over a house 35 feet high, across the street, fronted by trees 45 feet high. The tops of the latter were grazed and some of the highest branches torn away. Débris of the roof began to reach the ground about 50 yards away, and shingles were found 600 yards distant. The wall fronting the storm was blown inward and the other walls fell outward; the floor was moved 6 or 8 feet off its supports, which were brick pillars 6 feet in height.

The roof of the large auditorium was nearly intact, but near its southeast end a great hole was torn in it, say twenty feet square, and the piece, which was intact, seemed to have been blown upward, twisted almost completely around, and then dropped back into nearly its original position.

Now in each of these buildings there was a large amount of air inclosed, with no dividing partitions. According to my view the tornado simply took the air pressure off their sides and tops, and in consequence the inclosed air expanded from within and did the greater portion of the damage. It was not the force of the wind outside, but mainly the expansion of the confined air, that wrecked the buildings. Suppose that such public buildings should be so made that a space of, say, ten feet, all around just beneath the roof, could yield to a moderate pressure from within, would not the roof remain intact and the walls remain vertical?

HAILSTONES.

A few days ago I examined some hailstones under a small-power microscope. It has been said that hailstones all have a snowball for a nucleus. I think that this is a mistake. The white central sphere of the hailstone, inclosed in its rim of crystal, glassy ice, is simply normal ice. Put some water in a drachm vial and freeze it in a tumblerful of freezing mixture, consisting of two parts by weight of ice to one of salt, hold it up to the light, and you will find a central core of white amorphous ice, with crystalline ice enveloping it on all sides. There is no snowball to start with in this instance; the freezing always begins on the top, bottom, and sides, and the liquid center freezes last. I fully believe the hailstone is first a spherical drop of water; then its outermost rim reaches 32° F. in the surrounding cold, congeals, and the congelation gradually extends inward till the last of the liquid content becomes solid. Water can not be frozen in a tube or in any sort of way so that it will not be white in the center if the cold strikes it on all sides. Boil water, pour castor oil on it before it has a chance to reabsorb the three per cent of air that naturally belongs to it, freeze it, and you get amorphous ice (never crystalline), looking like paraffine. The central core is larger in the hailstone, in proportion, than it would be in a piece of ice of the same diameter frozen naturally in a tube or other vessel. This is because hail forms four to eight miles above the ground and there is less air in the water at that height than at the ground, where the pressure is 30 inches.

I think that large hailstones are simply aggregations and clusters of hail. Melt the top of a block of ice so that it is covered with moisture, cover it with another block of ice, and the two will unite solidly, even when the temperature outside is above 32° and the outsides of both blocks are in a melting state.

THUNDERCLOUDS.

A thundercloud is composed of fog particles, these particles being much smaller, according to the laws of gravity, at the top than at the broad black base. It seems to me that meteorologists generally teach that it is the condensation and coalescence of these particles that form raindrops, and that this coalescence takes place by the action of cold, and that it begins when the dew-point is reached. This is true in regard to fog particles only, and fog particles have still further to be condensed before they lose their spherical shape, and this requires a much greater degree of cold than any one seems to have thought necessary so far as I can learn. Mists above rivers or fogs on the coast are seen when the temperature is far below freezing. In other words, fog particles will not coalesce at temperatures below freezing.

We will suppose the peak of a thundercloud to reach eight and one-half miles. That height on a summer day has a temperature of at least —50° F., and yet you see before you a mass of vapor, boiling and seething, just as steam from an engine does on a cold morning. Heat from below is continually being supplied, and however cold the interior of the cloud may be, it is evidently not sufficiently so to consolidate the vapor. The very moment, however, that the vapor reaches the top edge of the cloud and encounters —50° F. of cold, each spherical fog or cloud particle is so constricted upon its inclosed, now much rarefied, air particle that the latter forces its way out just like the bursting of a soap bubble, and now instead of a film of water surrounding a globule of air you will have left a tiny mass of genuine, unadulterated water. This has appreciable weight, falls downward, rupturing by contact in its descent countless ascending fog particles, coalescing with them, and by the time the base of the cloud is reached a large drop of rain has been formed. Thus rain begins at the very top layer of the mass of fog particles and nowhere else. The higher the cloud, and the greater the number of fog particles encountered in the descent, the harder the rain. Every thundercloud shows the rain streak directly below the peak. A flash of lightning or peel of thunder is never noticed till those rain streaks appear below.

We print the above as coming from a close observer and logical reasoner, but doubtless others will differ from him as to facts and theories. The formation of hail and rain is not yet well understood. We hope that others will contribute to this subject; observations, theories, and experiments by careful physicists are much to be desired.—EDITOR.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

North Atlantic weather was not notably severe. Barometric pressure continued low over the British coasts. After the 4th high barometric pressure and settled weather prevailed over the Azores.

Ten areas of low barometer moved eastward over or near the Canadian Maritime Provinces, one of which advanced from the Gulf of Mexico, one from the subtropical region north of Cuba, and one from the north Pacific coast of the United States; the remaining low areas first appeared over the interior of the North American Continent.

Over the greater portion of the United States the month was exceptionally mild, and in parts of the Missouri and Red River of the North valleys the mean temperature for the month was 10° to 12° above the normal. Precipitation was irregularly distributed, and there was a general deficiency in snowfall.

In the Atlantic coast States the barometric depressions were of moderate intensity. Several energetic storms crossed the Great Lakes, those of the 3d–4th, 5–6th, and 14–15th being the most severe. The principal storms of the Pacific States occurred during the second decade of the month.

Attending low area I heavy snow fell in New Mexico on the 1st, and heavy rain in the lower Mississippi Valley on the 2d. On the 3d the barometer fell to 28.68 inches at Madison, Wis., at 8 p. m., snow fell in Iowa, Minnesota, Wisconsin, and Upper Michigan, heavy rain generally east of the Mississippi, and a strong gale prevailed over the upper Lakes. A tornado is reported as having visited Albany, Ga., at 2:30 p. m. Snow continued in the Lake region during the 4th. In connection with low area II high winds prevailed from the Great Lakes over the middle Atlantic and New England coasts. During the passage of low area III snow fell in the Ohio Valley and the Atlantic States to and including North Carolina on the 8th.

From the 12th to 14th low area IV moved northeastward off the Atlantic coast with gales that attained a reported maximum velocity of 67 miles an hour from the northeast at Nantucket, Mass., on the 14th. From the 11th to 13th low area VI caused heavy rain and high winds, on the Pacific coast. During the 15th and 16th low area VII passed northeastward over the Lake region, with rain from the lower Mississippi Valley over the Ohio Valley and Great Lakes. From the 16th to 18th low area VIII crossed the continent from the north Pacific coast to the Canadian Maritime Provinces. On the 22d heavy rain fell in the lower Mississippi Valley, and rain, sleet, and snow in the middle and upper Mississippi valleys, and on the 22d heavy rain was general from the Ohio Valley over the middle and east Gulf States, and snow fell over the upper Lakes. On the 26th heavy precipitation attended the passage of low area XI northeastward off the Atlantic coast, and snow was reported in the interior of South Carolina and Georgia.

The first and most important cold wave of January advanced over the interior and eastern parts of the country from the 19th to 24th, breaking a period of exceptionally high temperature that had continued generally east of the Rocky Mountains from the beginning of the month. During the 30th and 31st a moderate cold wave advanced from Manitoba over the Red River of the North and the upper Mississippi valleys.

Heavy frost occurred on the middle coast of the Gulf of Mexico on the 1st, 9th, 14th, 23d, and 24th, and on the Texas coast on the 24th and 25th. Freezing temperatures were reported at New Orleans, Mobile, and Pensacola on the 9th, 23d,

and 24th, and at Corpus Christi on the 23d and 24th. From the 1st to 5th heavy frost was reported daily in southern California.

BOSTON FORECAST DISTRICT.

The mean temperatures of the month were decidedly above normal in all sections, and the maximum readings that occurred from the 21st to the 24th were among the highest recorded in the January official observations. The warm weather during the period mentioned caused buds to start on some trees and leaves to appear on shrubs in sheltered places in central and southern sections. Ice disappeared from many streams and ponds. There was an absence of severe storms, with the exception of the storm of the 14–15th, when wind velocities of from 40 to 67 miles an hour occurred at coast stations. So far as known at this office no damage resulted from the gales. The precipitation of the month was generally much below the monthly average, and the greater portion of it occurred as rain. The light snowfall was unfavorable to the lumbering interests, and, owing to the prevalence of mild weather, there has been little ice harvested. There were no storms during the month with high winds for which warnings were not ordered.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

High winds prevailed along the west Gulf coast on the 9th and 22d, for which timely warnings were issued. No high winds occurred without warnings. Two general cold waves passed over the district during the month, one on the 8th and 9th and another on the 21st and 22d. Frost or freezing temperature warnings were issued for the sugar and trucking regions of Texas and Louisiana for every injurious condition that occurred during the month.—*I. M. Cline, District Forecaster.*

CHICAGO FORECAST DISTRICT.

Advices of impending storms were sent to open ports on Lake Michigan during the month. A well-marked storm developed in the southwest early in the month and reached the middle Mississippi Valley on the morning of the 3d, at which time messages advising the various interests that severe and dangerous gales would occur were issued. The storm continued to develop great energy and moved directly across the Lake region, accompanied by general gales for 24 hours. Advices were sent out on the 4th that the storm would gradually lose force. There was no other severe storm until the 15–16th. Advisory messages were issued in advance of this storm. The storm which appeared in the Pacific coast region on the 17th moved very slowly southeastward and thence northeastward over the Lake region, reaching the Lakes by the morning of the 22d and causing high winds until the morning of the 23d. Advices were sent out 24 hours in advance of its occurrence.

There was no general cold wave during the month, although the temperatures were very low in the northwest from the 21st to the 23d. Cold-wave warnings were issued on the 19th, 20th, 21st, and 22d, resulting finally in a display at all stations. The warnings were verified at the majority of the stations, and a remarkable fall in temperature occurred at practically all points, although limiting temperatures were not reached in some cases. No other general cold-wave warnings were issued. The chief value of the warnings lay in the fact that abnormally high temperatures for the season had previously prevailed. This storm was accompanied by rain, changing to sleet and snow, which caused great damage to telephone and telegraph lines. The temperatures were, as a rule, far above the normal over the greater portion of the district, and it was the warmest January since 1880.—*H. J. Cox, Professor and District Forecaster.*

LOUISVILLE FORECAST DISTRICT.

The month was unusually mild and fair, there being only two periods, 8–9th and 23d to 26th, when the temperature was below normal. On the 20th and 21st the temperature was 70° to 80° over the greater portion of Kentucky and Tennessee, the highest generally for January since the establishment of the National Weather Bureau Service. Thunderstorms were quite general on the 15th. Three general storms passed across or near the district during the month, giving rain and high winds; these occurred 2–3d, 14–15th, and 20th–22d. The month was remarkably free from snow, there being only one snowstorm, on the 8th, over any great portion of the district. On the 26th snow fell quite heavily in the mountain portions of Kentucky and Tennessee, but none elsewhere in either State. Cold-wave warnings were issued the night of the 7th and morning of the 8th, and again on the 20th and 21st. These warnings were fully justified.—*F. J. Walz, District Forecaster.*

DENVER FORECAST DISTRICT.

In western Montana and in the mountain districts of the western slope the month was cold, with here and there an excess of precipitation, while mild and dry weather was almost continuous in the plains region of the eastern slope. In southwestern Colorado the stormy period of the 18th, 19th, and 20th, which was forecast, was followed by the most destructive snow slides in the history of San Juan district. Five lives were lost from this cause, and the Denver and Rio Grande Railroad was blocked for thirteen days in Animas Canyon. The greatest depth noted in connection with these slides was 63 feet. The most important cold wave of the winter followed the low pressure area that overlay the middle Rocky Mountain region on the morning of the 20th. Timely warnings were given full distribution in southern Wyoming, northern Arizona, southwestern and eastern Colorado, and northern and eastern New Mexico, which was the area covered by the cold wave.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

The month, as a whole, was pleasant, the condition during the early portion being favorable for heavy frost generally in the interior of California. Ample warning was given to fruit growers, and losses due to frost were therefore small. On the morning of the 11th a general warning of rain and southerly winds was issued, and the storm that followed broke a prolonged dry period that was beginning to seriously interfere with farming operations. Ample warning was also given to river interests concerning the probable effect of the heavy rains upon river heights. The third decade, like the first, was dry.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND FORECAST DISTRICT.

The stormy period of the month was between the 11th and the 25th, during which time four noteworthy disturbances passed across the district. The third one evidently resulted from the coalescence of two minor disturbances, which were first noted over Nevada and western British Columbia, respectively. It moved east across the southern portion of the district. The last one made its appearance off Cape Flattery on the evening of the 21st, and moved slowly northeastward. The steamer *Valencia* was wrecked on Vancouver Island during the passage of the last storm and 117 lives were lost. From the 25th to the end of the month, the weather was controlled by a stagnant high pressure area which settled over southern Idaho, and but little precipitation occurred thereafter. Timely warnings were issued for all gales. No cold waves occurred and no cold-wave warnings were issued.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

Owing to the continued absence of normal winter conditions, river stages were generally higher than is usual during the month of January. Temperatures were high and rainfall abundant, and, as a consequence, the great rivers were well supplied with water, while moderate floods occurred in many of the smaller rivers. Danger-line stages were exceeded in a number of these floods with the usual accompaniment of flooded lowlands. Along the headwaters of the Tennessee

River, and in the mountain districts of the Virginias, a great amount of damage was done to railroads and bridges.

The Grand River of Michigan was in flood during the last decade of the month, the first January flood for a great many years. At Grand Rapids, Mich., the maximum stage of the water was 11.5 feet, 0.5 foot above the danger line, and some of the lower factory basements along the river front were flooded.

The heavy rains in California from the 17th to the 19th, inclusive, caused a flood in the Sacramento River, and some unusually high stages were reported. At Red Bluff, Cal., the maximum stage was 25.3 feet, 2.3 feet above the danger line, while at Marysville, Cal., the crest stage was 21.6 feet, 1.6 feet above the previous high-water mark of February 25 and March 20, 1904. Some damage occurred from Colusa, Cal., northward, the most serious of which was the breaking of the Crocker levee in Colusa County.

Warnings were issued in advance of all the floods, and reports received indicate that they were of great value to all interested.

At the end of the month the Missouri River was frozen as far south as the northern Nebraska line, and the ice had increased somewhat in thickness to the northward. The quantity, however, still continued to be less than that of the previous winter. The Mississippi River was frozen as far south as Leclaire, Iowa, whereas at the end of January, 1905, it was frozen as far as St. Louis where the ice was 11 inches in thickness. There was some increase in the ice in the rivers of northern New England, but there were still from eight to twenty inches less than at the corresponding period of 1905.

The rivers of the other districts were comparatively low, and nothing of more than ordinary interest was noted.

The highest and lowest water, mean stage, and monthly range at 287 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Professor of Meteorology.*

CLIMATOLOGICAL SUMMARY.

By Mr. JAMES BERRY, Chief of the Climatological Division.

The following summaries relating to the general weather and crop conditions during January are furnished by the directors of the respective sections of the Climatological Service of the Weather Bureau; they are based upon reports from cooperative observers and crop correspondents, of whom there are about 3300 and 14,000, respectively:

Alabama.—The mild weather was favorable for winter grain, though frequent rains kept the ground too wet for work. It was unseasonably warm from the 15th to 22d, though light freezes occurred during the first decade and the latter part of the third decade. Rainfall was heavy to locally excessive on the 21st and 22d. Wheat and fall oats advanced well. Little progress was made in seeding spring oats. Fruit trees continued in good condition. Preparation for staple crops was begun in southern counties during the last week.—*F. P. Chaffee.*

Arizona.—The month was unusually cold and cloudy from the 1st to the 25th, with a small amount of precipitation. Farm work was practically suspended, and winter feed was scarce in the northern counties, due to the accumulated depths of snow and the frozen condition of the soil. Wheat, oats, and barley grew slowly; in the southern counties these crops were still being sown. Almonds and strawberries were in bloom. The river beds were full of water. A large yield of citrus fruit continued. The ranges and cattle in the southern sections were in excellent condition.—*L. N. Jesunofsky.*

Arkansas.—The mean temperature was slightly above normal, but very cold weather prevailed during the first and last decades. The precipitation as a whole was slightly above normal, and excessive locally in the northwest. Snow occurred on several dates and was general on the 22d, with monthly amounts ranging from trace to 11.5 inches. The weather was generally unfavorable for farm work. Wheat and oats were in fairly good condition. Fruit was generally uninjured. Cotton picking was finished. Stock was generally in good condition, except locally in the southwest.—*H. F. Alciatore.*

California.—The dry northerly winds and low temperature early in the month were followed by warm weather and generous, well distributed rainfall, with heavy snowfall in the mountains. The rain and melting snow caused high water and overflow of rivers in the central and northern sections, resulting in considerable damage to grain fields. On the whole, the rain was exceedingly beneficial, and by the close of the month grain and grass were in good condition.—*Alexander G. McAdie.*

Colorado.—Except for a brief period, the weather was mild and unusually favorable to live stock on the eastern slope, but in parts of the western slope and San Luis Park it was very cold. Range grass was covered with snow in some of the western and northwestern counties, but elsewhere grazing was not seriously interrupted. For the time of the year range cattle, horses, and sheep were generally in fine condition throughout the State.—*Fred. H. Brandenburg.*

Florida.—The temperature averaged practically normal. There were much cloudiness and some heavy rains, the greatest amounts of rainfall occurring over western counties and the least over the southern district. A fair acreage was sown to oats and some land was prepared for corn. Farmers were mostly engaged during the latter half of the month clearing fields and burning trash. Vegetables were backward, owing to frequent rains, but citrus trees were well advanced, many showing bloom.—*A. J. Mitchell.*

Georgia.—Land was damaged somewhat and farming operations were retarded by excessive precipitation. Winter grains showed good stands, and satisfactory progress was made by these crops in most localities. Fruit suffered no injury, the trees being in excellent condition generally. Scarcity of labor was reported from some localities. Roads were bad and very little hauling was done.—*J. B. Marbury.*

Hawaii.—Temperatures were generally above normal during the first half of the month, but were abnormally low during the latter half; the nights were very cold during the second and third decades. Although rather heavy showers occurred in portions of windward Hawaii, eastern Maui, and northern Kauai during the first few days, and heavy leeward rains were general during the latter part of the second decade, the month as a whole was dry for this season of the year. High winds occurred at intervals all the month, and exceptionally stormy weather prevailed during the second decade, causing considerable damage to young cane, plantation buildings and flumes, trees, and shrubs, especially in northern Hawaii and Maui. The growth of young cane was retarded by low temperatures, but conditions during the first and third decades were very favorable for ripening of 1906 cane and for harvesting, which proceeded rapidly in all sections. Ripening of winter pineapples was retarded during the first and third weeks by cloudy days and cold nights. Preparation of rice lands was general throughout the month; by the close of the month the setting out of seedling plants had begun in all sections. Coffee picking was virtually finished during the month, the yield on the whole meeting the expectations of growers. Leeward pastures were dry during the early part of the month, but were greatly helped by the rains of the second decade.—*Alex. McC. Ashley.*

Idaho.—Snow covered most of the winter range during the month, necessitating continued feeding of stock. In some localities feed became very scarce, but most stock came through the month in good condition. Winter grain was well protected by snow. Fruit trees and shrubs were reported as wintering well.—*Edward L. Wells.*

Illinois.—The month was the mildest January since 1880. Precipitation was above normal, being heavy in parts of the southern district. Wheat maintained a good winter condition. The plant was exposed most of the season, but the weather had not been sufficiently rigorous to cause damage. Corn was keeping well; a considerable portion of the crop had been marketed. Meadows and pastures had wintered well. Apples and potatoes were not keeping well.—*Wm. G. Burns.*

Indiana.—The prevailing warmth, with frequent, but generally light, rains from the 3d to 23d, inclusive, caused a rather rank growth of wheat, rye, and grasses. There was a slight improvement in the general condition of southern bottom lands, but in most cases the moisture continued excessive. Early fruit buds formed prematurely and were in danger from later freezes. Some plowing for oats was done during the last two weeks.—*W. T. Blythe.*

Iowa.—The month was abnormally warm, with less than the usual amount of stormy weather. The average precipitation was slightly above normal and mainly in the form of snow; the ground was generally well covered during the prevalence of lowest temperature, affording protection to winter wheat and rye. Conditions were favorable for stock feeding and the usual winter work on farms.—*John R. Sage.*

Kansas.—The past January was the warmest since 1886, except that of 1900, when the average temperature was the same. The precipitation was slightly below normal, but the ground remained moist. Wheat continued in good condition. Plowing for spring crops continued, and was nearly completed in Chautauqua County by the close of the month.

Fruit buds were not injured. The weather was quite favorable to stock, which wintered well.—*T. B. Jennings.*

Kentucky.—The weather was unusually mild. There was no damaging cold, though there was slight damage from alternate freezing and thawing. Practically no snow covered the ground. Wheat, rye, and grass were in fine condition. Fruit trees were uninjured, but warm weather caused buds to swell. Stock was in excellent condition and feed was plentiful. Farm work was well advanced and some plowing for hemp and corn was accomplished.—*F. J. Walz.*

Louisiana.—Rain and occasional low temperature interfered with outdoor work and, except in scattered localities, very little progress was made in farming operations. Preparations for cotton and corn crops were very backward. Rye and oats were doing well. The remainder of the sugar crop was harvested during the month. Seed cane was in good condition. Fall plant cane was doing well. Truck gardens suffered from low temperatures.—*I. M. Cline.*

Maryland and Delaware.—With but one exception January was the warmest winter month in the past fifteen years. Only one cold wave was experienced and that was not severe nor general. Precipitation was about normal and well timed. Rose bushes and other early plants burst into full leaf, and various shrubs into bloom. Wheat, clovers, and grasses became green and made decided growth. Fruit buds swelled considerably, but were not considered sufficiently advanced to be in jeopardy.—*C. F. von Herrmann.*

Michigan.—January was an unusually mild month. The precipitation was about normal, but there was considerably less snow than usually occurs, especially in the central and southern counties. The ground was without material snow protection in the principal agricultural counties the greater part of the month, but owing to the absence of any extremely cold weather winter wheat and rye did not suffer. Both cereals made fairly good winter growth and at the close of the month looked healthy and promising.—*C. F. Schneider.*

Minnesota.—Mean temperatures were everywhere considerably above normal. The minimum temperatures, which were all below zero, occurred on the 8th and 22nd, and the maximum temperatures on the 26th to 29th. Considerable snow covered the State all the month, the greatest depth being in eastern and northern portions. Ice was cut all the month, but the thickness was less than usual. No work in the soil was possible. Building operations of all kinds continued without interruption.—*T. S. Outram.*

Mississippi.—Cold waves overspread the State on the 9th and 23d, but the month as a whole was milder than usual, with unseasonably high temperature from the 15th to the 21st, inclusive. Heavy rains occurred on the 2d, 3d, 21st and 22d, but no precipitation was recorded subsequent to the 23d. The soil was generally too wet for plowing until the last week, when conditions became favorable and farm work was quite generally commenced. Preparations for truck gardening were making splendid progress at the close of the month.—*W. S. Belden.*

Missouri.—The weather of the month was pleasant and was of much the same general character as that which prevailed during December. There were very few stormy or disagreeable days, the greater part of the month being bright and sunny. Wheat was fairly well protected by snow covering and the crop was reported to be in good condition. Fruit buds were advanced and swollen, but remained uninjured at the close of the month.—*George Reeder.*

Montana.—The month was unusually mild and free from severe storms. Ranges were open in the eastern portion, but mostly covered with snow in the western, where nearly all stock was fed. Cattle, sheep, and horses were generally in satisfactory condition. Wheat was well protected by snow in the western counties, but fields were mostly bare in the eastern portion.—*R. F. Young.*

Nebraska.—The warm, pleasant month was exceptionally favorable for stock and for all work in the open air. The ground was without snow covering practically the whole month. There was little wind and no severely cold weather to injure winter wheat, which continued in good condition.—*G. A. Loveland.*

Nevada.—The mean temperature for the State was slightly above normal, and the average precipitation was 0.71 inch above normal. Remarkably heavy storms occurred in the northern and western sections from the 11th to the 19th, but mild weather during the last decade melted the snow rapidly, and no great loss of stock resulted. In the southern section cattle and sheep were in fine condition and were wintering on the range.—*H. F. Alps.*

New England.—The weather of the month was unusually mild. The snowfall was moderate and there was an absence of severe storms and cold waves. The mean temperature for the month and the maximum temperatures from the 21st to 24th were among the highest recorded in any January. At the close of the month there was but little frost in the ground, and no snow on the ground except in the northern parts of the section. Stock continued to winter well, and the mild weather was favorable for outdoor work and wood cutting.—*J. W. Smith.*

New Jersey.—The month was noted for its remarkably mild temperature, there being only one cold period, from the 9th to the 11th, when the temperature fell to zero or below at some places in the northern section. The snowfall was abnormally light, and was insufficient to afford protection to the winter grain. Late sown wheat improved and suffered no serious injury from the frequent freezing and thawing. Fruit buds were swelling at the close of the month.—*Edward W. McGann.*

New Mexico.—The precipitation of the month was light, but soil moisture was abundant, as most of the heavy snow of December was absorbed. Temperature conditions were generally favorable and stock of all kinds was in good condition; losses were few and little feeding was required. Considerable plowing was done during the month, and general preparation was made for early spring work in central and southern counties.—*Charles E. Linney.*

New York.—The month was generally mild and pleasant. The temperature averaged considerably above normal and was very high on the 21st and 22d. While the precipitation was light, it was generally sufficient. Wheat and rye were fairly well protected by a covering of snow during the coldest part of the month. The warm weather of the 21st and 22d caused grasses and some fields of winter grain to take on a greenish tinge and sap started slightly in the trees.—*W. C. Devereaux.*

North Carolina.—The temperature and rainfall for the month were above the normal. In general the weather was favorable for growing crops, but there were some complaints in the central counties of too much rain. Winter wheat, rye, and oats were reported in good condition. Strawberries were doing well, and gardens exceptionally well. Considerable damage to fruit trees was sustained in the north-central counties, owing to a heavy sleet storm.—*A. H. Thiessen.*

North Dakota.—The month was unusually mild, with an abundance of sunshine during the greater portion and an absence of severe storms. These conditions were unusually favorable for stock. In the western part of the State, where the snow was light, stock was able to feed on the ranges throughout the greater portion of the month, and very little feeding of hay was necessary.—*B. H. Bronson.*

Ohio.—The weather during the month was very mild. The precipitation was mostly in the form of rain, but the ground was well protected by snow during the coldest period, especially in the south, where the lowest temperatures were recorded. Outdoor work progressed favorably. Wheat and rye were generally in good condition and made good growth. Fruit buds appeared safely dormant, notwithstanding the abnormal temperature conditions. Tobacco was mostly stripped.—*J. Warren Smith.*

Oklahoma.—The temperature averaged above normal. The severe cold wave of the 22d and 23d caused no material injury to stock or fruit trees. The precipitation was generally deficient, but the soil continued in excellent condition for plowing, which progressed under generally favorable conditions. Wheat made a moderate growth, and showed a good, healthy stand, except in a few localities. Stock was healthy and wintering well.—*J. P. Slaughter.*

Oregon.—In the high sections fall wheat was covered by snow, and in the low sections no severe cold spells occurred; therefore the wheat crop everywhere was in good condition at the close of the month. Neither grass nor grain made any growth of consequence and pasturage was unusually short, which necessitated the feeding of a large amount of hay to range and dairy stock. No plowing or seeding was done.—*Edward A. Beals.*

Pennsylvania.—The past January was the warmest in eighteen years. The unusually mild weather was favorable for outdoor work. The precipitation was unevenly distributed, but ample. Very little frost was in the ground, which was without snow protection. Winter grain was well set and thrifty, although there was some complaint from northern counties of alternate thawing and freezing. Stock and pastures were in excellent condition.—*C. J. Doherty.*

Porto Rico.—The weather was generally very dry and favorable for the maturing of the cane crop, but somewhat detrimental to young canes, tobacco, and small crops. Most of the sugar mills were in operation by the close of the month. The yield of cane was generally good, but the grade of juice was somewhat below the normal for the season. October sown tobacco was harvested; the yield was reported good to excellent. Coffee trees were in excellent condition and full of buds.—*E. C. Thompson.*

South Carolina.—The daily temperatures were generally favorable for maintaining winter grain crops in good condition and for the growth of truck crops in the coast districts, where fruit trees began to bud and peach trees to bloom. Wheat and oats were not winter killed. The precipitation was excessive and rendered the soil unfit for plowing, except on uplands in the eastern portions, where some plowing was done.—*J. W. Bauer.*

South Dakota.—The month was warmer and more agreeable than usual, with rather less than the normal amount of precipitation. The weather was very favorable for stock, which was in very satisfactory condition. Range pasturage was good, and, except in some extreme northern counties, the snowfall was generally too light to prevent the steady grazing of stock on the ranges. Absence of continuous snow covering was considered unfavorable to winter grains in some southern localities, but there was no special damage apparent.—*S. W. Glenn.*

Tennessee.—The mild weather was favorable to the germination of late sown wheat, which generally showed good stands at the close of the month, but it was rather warm for a healthy growth of early wheat. There was but slight damage from freezing and thawing. Oats were in good condition and pastures were better than usual at this season. Precipitation occurred frequently, but the monthly amounts averaged about

SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS, JANUARY, 1906.

In the following table are given, for the various sections of the Climatological Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	47.2	+ 2.8	3 stations	80	18, 20	Valley Head	15	9	4.66	—0.32	Lucy	7.72	Daphne	2.66
Arizona	42.9	— 1.1	Parker	84	27	Flagstaff (a)	—20	2	0.73	—0.48	Huachuca Reservoir.	4.36	5 stations	0.00
Arkansas	43.1	+ 2.9	Centerpoint Jonesboro	82 82	18 21	Eureka Springs	— 2	23	5.19	+1.07	Warren	9.60	White Cliffs	1.16
California	47.5	+ 1.9	Hanford	95	6	Bodie	—13	8	7.86	+2.83	Helen Mine	38.75	4 stations	0.00
Colorado	26.4	+ 3.4	Lamar	78	31	Gunnison	—45	22	0.69	—0.08	Silverton	3.00	Las Animas	0.00
Florida	58.3	+ 0.2	Orange City	88	22	Molino	21	24	4.60	+1.56	Bonifay	11.63	Fort Myers	2.02
Georgia	47.5	+ 3.2	St. George	83	22	Diamond Ramsey	16 16	9 10	6.06	+2.22	Bowersville	11.14	Poulan	2.45
Hawaii	68.3†	......	Kihei, Maui	87	7	Humuula, Hawaii	29	31	4.80‡	......	Nahiku, Maui	17.51	Kukaiau, Hawaii	0.23
Idaho	25.4	+ 0.2	Oakley	55	18	Chesterfield	—30	8	2.71	+0.46	Landore	6.51	Lewiston	0.58
Illinois	32.7	+ 6.5	Equality	75	20	Lanark	— 6	9	3.34	+1.11	Equality	7.60	La Grange	1.61
Indiana	35.4	+ 7.2	3 stations	74	20, 21	Mauzy, Richmond	—11	9	3.09	—0.21	Princeton	7.10	Franklin	1.35
Iowa	24.6	+ 4.8	Keokuk	69	20	Charles City	—19	8	1.52	+0.57	Ridgeway	4.71	Inwood	0.28
Kansas	35.2	+ 5.4	Englewood	77	19	Columbus	— 6	23	0.71	—0.04	Walnut	2.83	Hugoton	T.
Kentucky	39.7	+ 5.5	Loretto Scott	80 80	21 20	Farmers	— 9	9	3.48	—0.31	Blandville	7.84	Irvington	1.43
Louisiana	51.0	— 0.8	Minden	85	18, 20	Robeline	14	24	3.30	—1.44	Clinton	6.19	Minden	0.80
Maryland and Delaware.	38.8	+ 7.4	Millsboro, Del	76	23	Oakland, Md	— 6	10	2.88	—0.16	McDonogh, Md	4.74	Porto Bello, Md	1.08
Michigan	28.8	+ 8.8	Coldwater	70	21	Humboldt	—21	24	2.82	+0.65	Old Mission	6.32	Grape	0.89
Minnesota	17.0	+ 7.0	Hovland	58	27	Detroit City	—39	22, 23	1.15	+0.44	St. Charles	1.97	Angus	0.07
Mississippi	47.4	+ 1.2	5 stations	80	18–20	Booneville	14	9	3.97	—1.15	Magnolia	7.30	Pontotoc	2.26
Missouri	35.6	+ 5.4	4 stations	76	20	3 stations	— 8	9, 23	3.64	+1.31	Pinehill	7.88	Conception	0.60
Montana	24.7	+ 5.2	Billings Fort Logan, Steele	65 65	31 25	Grayling	—33	21	0.78	—0.04	Saltese	5.46	Chinook	0.04
Nebraska	30.0	+ 6.7	3 stations	68	3 dates	Lynch	—24	8	0.46	—0.02	Kennedy	1.30	Ewing	0.00
Nevada	28.4	+ 0.7	Wabuska	66	18	Potts	—15	2, 8	2.32	+0.71	Lewers Ranch	14.33	McAfees Ranch	T.
New England*	30.1	+ 7.5	Torrington, Conn	69	22	Van Buren, Me	—25	19	2.83	—0.91	Durham, N. H	6.50	Burlington, Vt	1.00
New Jersey	36.5	+ 6.5	3 stations	74	22	Layton	— 5	9	2.85	—0.87	Flemington	3.86	Cape May City	2.08
New Mexico	34.2	— 0.4	Roswell	79	17	Tres Piedras	—19	22	0.42	—0.19	Chama	2.10	Palma	0.00
New York	30.3	+ 8.5	4 stations	72	21, 22	North Lake	—27	8	1.86	—1.00	Cold Spring Harbor.	4.49	Hemlock Lake	0.39
North Carolina	43.9	+ 4.8	Tarboro	81	22	Buck Springs	3	10	5.86	+1.60	Pink Beds	16.87	Weldon	2.77
North Dakota	12.2	+ 5.4	Palermo	60	31	Willow City	—38	22	0.69	+0.19	Willow City	1.60	Flasher	0.09
Ohio	35.7	+ 7.7	Ironton	79	21	Pulse	—14	9	1.98	—0.74	Jacksonburg	3.89	Bowling Green	0.72
Oklahoma and Indian Territories.	40.5	+ 3.6	Shawnee, Ind. T	85	21	Okmulgee, Ind. T	—15	23	1.28	—0.05	Stilwell, Ind. T	3.45	Chattanooga, Okla	0.04
Oregon	37.7	+ 1.9	Fairview	74	30	Riverside	— 8	1	5.15	—0.37	Glenora	19.78	Umatilla	0.60
Pennsylvania	35.0	+ 8.0	Freeport	85	22	Derry Station Wellsboro	— 4 — 4	9 9	2.53	—0.74	Somerset	5.28	Lawrenceville	0.76
Porto Rico	73.5	......	Adjuntas	93	4	Adjuntas	46	6	1.67	......	Aibonito	5.50	Coloso	0.05
South Carolina	47.0	+ 2.5	Walterboro	83	20	Seivern	12	10	5.85	+2.53	Liberty	11.69	Bennettsville	3.52
South Dakota	21.5	+ 6.9	Hermosa	66	28	Grand River School.	—31	22	0.40	—0.08	Elk Point	1.35	White Horse	T.
Tennessee	42.1	+ 4.4	Sparta	77	22	Jonesboro	2	9	4.58	—0.01	Silver Lake	7.93	Dover	2.08
Texas	48.5	+ 0.6	Tilden	89	20	Dalhart	— 2	22	1.15	—1.13	Nacogdoches	4.85	2 stations	0.00
Utah	25.3	— 1.1	Plateau, St. George	70	27	Strawberry Valley	—39	9	1.60	+0.28	Meadowville	5.45	Frisco	0.10
Virginia	40.8	+ 5.7	Arvonia	77	22	3 stations	2	9, 10	3.73	+0.69	Burkes Garden	6.43	Shenandoah	1.72
Washington	35.2	+ 3.3	North Head	65	31	Twisp	— 8	20	4.05	—0.56	Clearwater	18.57	Kennewick	0.23
West Virginia	38.2	+ 7.2	Wheeling	80	21	Philippi	— 5	10	3.79	+0.29	Princeton	8.70	Wheeling	1.36
Wisconsin	21.7	+ 6.4	Stevens Point	64	27	Grantsburg, Osceola.	—28	8	2.47	+1.36	Osceola	4.50	Berlin	1.30
Wyoming	21.6	+ 1.7	Pine Bluff	68	26	Border Daniel	—31 —31	8, 9 22	1.17	+0.24	Upper Geyser Basin, Y. N. P.	4.88	4 stations	T.

* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. † 51 stations, with an average elevation of 752 feet. ‡ 145 stations.

the same as the normal. Fruit buds became considerably swollen during the period of unusually high temperature from the 14th to 22d.—*H. C. Bate.*

Texas.—Precipitation occurred mostly during the first few days of each decade and was decidedly deficient for the State. The mean temperature was about normal. Farming operations generally progressed nicely and small grain did well in most sections, but garden truck was much damaged by freezing temperatures. Some cotton remained unpicked and was probably a total loss. Range grass and stock suffered from want of water in western and northwestern counties, but there was comparatively little loss.—*B. Bunnemeyer.*

Utah.—Settled weather prevailed, except during a short period at the middle of the month, when general storms gave considerable rain and snow over the State, thus securely protecting winter grain and producing an improved outlook for spring growth. Winter fed stock was doing well, but animals on the range were beginning to suffer in localities, owing to the deep snow. Farm work was confined principally to teaming, orchard work, and stock feeding.—*R. J. Hyatt.*

Virginia.—The weather of the month was generally mild, and, on the whole, favorable for crop progress. All winter crops did well, especially wheat, oats, rye, barley, and grasses, while owing to the open weather considerable plowing was done. Seed beds for tobacco were prepared in some localities. Orchards received some damage, generally from ice caused by freezing rains. No ice was harvested during the month.—*Edward A. Evans.*

Washington.—The mild weather of the month was favorable for winter wheat, barley, and fruit trees, there having been no severe cold spells to cause injury. Wheat was somewhat backward, however, as regards growth, and stands were thin. It was generally in good condition, although a report from Klickitat County stated that fall-sown grain looked poor. There was no snow covering for the wheat at the end of the month.—*G. N. Salisbury.*

West Virginia.—The exceptionally warm weather during the month was very favorable for farm work. Winter wheat and rye were doing well, although they suffered from lack of snow protection during the freezing intervals of the month. Stock was in good condition, and there was sufficient feed on hand. Plowing for spring planting had commenced in some sections.—*H. C. Howe.*

Wisconsin.—The temperature averaged considerably above the normal; the excess was well distributed throughout the month, although unseasonably high temperatures were recorded at a few stations during the last decade. The precipitation was above the normal and well distributed. Winter crops were doing nicely and the snow covering was ample. Stock was in good condition.—*J. W. Schaeffer.*

Wyoming.—Over the eastern half of the State, the month was unusually favorable for stock interests, the range having been free from snow for the greater part of the month. Over the western half, snowfalls were much heavier, covering much of the range and necessitating more feeding. At the close of the month stock was in good condition and losses had been small.—*W. S. Palmer.*

THE WEATHER OF THE MONTH.

By Mr. Wm. B. Stockman, Chief of the Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart VI and the average values and departures from normal are shown in Tables I and V.

The contours of the isobars of mean barometric pressure for the month over the Rocky Mountain and Pacific regions closely approached the normal, while over the southeastern portion of the country they differed considerably therefrom.

Areas of high pressure overlay the middle and southern Plateau and slope districts and the region from Virginia and southern New Jersey southwestward to the central portion of the Texas coast. The crest of mean high barometer overlay the southern portion of Idaho, from which section average pressures of about 30.25 inches were reported.

The mean barometer was lowest over the extreme northwestern coast of Washington, where a minimum mean pressure of 29.95 inches occurred.

The mean pressure was above the normal for the month in the Atlantic States as far south as central North Carolina, in the eastern portions of Tennessee and Kentucky, West Virginia, southeastern Ohio, Louisiana, Texas, the middle and southern slope and Plateau regions, and California, except the extreme northwestern portion; elsewhere it was below the normal.

The greatest positive departures ranged from +.05 to +.14 inch, and occurred over New England, the western portions of the southern and middle slope regions, the middle and southern Plateau regions, and southeastern California; the maximum excess being reported from central and western New Mexico, extreme western Colorado, and southwestern Wyoming.

The greatest negative departures ranged from —.05 to —.10 inch, and occurred over the greater portions of the upper Lake region, upper Mississippi and Missouri valleys, and eastern and northern North Dakota, the maximum deficiency being reported from northwestern Iowa and extreme southeastern South Dakota.

The mean pressure for the month exceeded that of December in the Atlantic districts, southern portion of the east Gulf and extreme southeastern portion of the west Gulf States, and northern North Dakota; and diminished from the preceding month in the remaining districts. The greatest increases were but +.05 to +.08 inch, and occurred over eastern and southern New England and southern Florida. The decreases were much more marked both in extent of territory covered and amount, ranging from —.05 to —.14 inch over the district from southern Lake Michigan, Illinois, northwestern Arkansas, and north-central Texas, westward to the Pacific coast at about latitude 36° and to the northward thereof, and northwestward over north-central Montana.

TEMPERATURE OF THE AIR.

The mean temperature for the month was below the normal in southern and extreme western Florida, the Rio Grande Valley, the extreme western parts of New Mexico and Colorado, southwestern Wyoming, Utah, except the extreme northwestern portion, eastern Nevada, and northern Arizona; in the remaining sections of the country the mean temperature was above the normal.

The negative departures were small and in no case exceeded —2°, while the positive departures were very marked, exceeding +4° over the greater portion of the area; +6°, or more, over the region north of a line drawn from southern New Jersey southwestward to east-central New Mexico and eastward of a line drawn from this point generally northwestward over eastern Washington; +8°, or more, northward of a line run from east-central New York to northeastern New Mexico and eastward of a line from that point trending generally northwestward over western Montana; +10°, or more, in east-central southern Michigan, western Minnesota, eastern North Dakota, western and southern Montana, South Dakota, except the central portion, Nebraska, and northern and western Kansas; and +12° to +14° in western Minnesota, northeastern South Dakota, and southeastern Montana.

The mean temperature was above the normal in all geographic districts.

The isotherm of 60° of mean temperature crosses Florida about latitude 29°; 50° touches the coast of central North Carolina, then trends a little to the southwestward from the Atlantic coast, at about latitude 33°, to the Rio Grande Valley in latitude 30°, and northwestward from south-central Arizona to the Pacific coast about latitude 49°; 40° trends in a general southwestward direction from central Delaware to south-central New Mexico, thence northwestward to central California about latitude 42°, thence northward to the Canadian boundary; 30° from the northern boundary of Massachusetts westward over central Lower Michigan, thence southwestward to northwestern Missouri, thence somewhat to the north of west to meridian 105°, when it takes a sharp bend to the southward into central New Mexico, thence generally westward to central Arizona about latitude 35°, thence somewhat to the northeastward into southern Utah, thence westward into north-central California, northward to the western part of central Oregon, northeastward to west-central Idaho, recurving westward to east-central Washington, thence northward to the boundary at meridian 121°, also small portions of southwestern South Dakota and southwestern Idaho are within the isotherm of 30°; 20° trends westward from the eastern boundary of Maine about latitude 46°, to the extreme western part of Lake Superior, thence southward to northeastern Iowa, westward to longitude 100° at the southern boundary of South Dakota, and thence northwestward to the boundary about longitude 114°; portions of western Wyoming and northern Colorado and the northeastern portion of Utah and southeastern Idaho are inclosed by the isotherm of 20°. Portions of northwestern Minnesota and northeastern North Dakota are within the area of 10°, or less, of mean temperature.

Maximum temperatures of 80°, or higher, occurred in extreme southeastern Georgia, the Peninsula of Florida, the lower and central parts of the Rio Grande Valley and central Texas, and in portions of southwestern California; of 70° to 80° in the region eastward of meridian 101° and southward of parallel 40°, except in the mountain regions of Georgia, eastern Tennessee, western North Carolina, western Virginia, and western Maryland, also in western Pennsylvania, extreme western New York, Ohio, upper Rio Grande Valley, southeastern New Mexico, southern and western Arizona, and southwestern and the interior of extreme northern California; of 60° to 70° in the Alleghany regions from northwestern Georgia northeastward, in the interior of New Jersey, Connecticut, Rhode Island, and Massachusetts, southwestern Maine, southern parts of New Hampshire and Vermont, northern portions of Indiana and Illinois, extreme southeastern Wisconsin, southeastern Iowa, Nebraska, except the extreme northeastern portion, southwestern South Dakota, southeastern Wyoming, eastern Colorado, extreme northwestern Texas, eastern and southern New Mexico, southern and western Arizona, northern and eastern California, extreme western Oregon, and in portions of western Montana; 50° to 60° in central Lower Michigan, extreme southern Wisconsin, Iowa, except the extreme southeastern and north-central portions, South Dakota, except

the southwestern and northeastern portions, southwestern North Dakota, Montana, except the extreme northeastern and northwestern portions, central Idaho, western and southern Washington, northern and central Oregon, central Nevada, southern, central, and north-central Utah, northeastern Arizona, northwestern Mew Mexico, southwestern Colorado, and eastern Wyoming, except the extreme southeastern part; of 40° to 50° from central Maine, northern Lower Michigan, Upper Michigan, Wisconsin, except the extreme southern part, Minnesota, except the extreme northwestern part, southeastern and northwestern North Dakota, extreme northeastern and northwestern Montana, northeastern Washington, northwestern Colorado, northern Utah, except the central portion, western Wyoming, southern Idaho, southeastern Oregon, and northern Nevada; and of less than 40° from northwestern Minnesota, and northeastern North Dakota.

Minimum temperatures below the freezing point occurred everywhere, except over the greater portion of the Peninsula of Florida and portions of the central coast of Texas, and the southwestern and central coasts of California; of zero or lower in the northern portions of Maine, New Hampshire, and Vermont, western Massachusetts, interior New York, western Upper Michigan, central and western Wisconsin, Iowa, except the eastern part, northwestern Missouri, Nebraska, except the south-central part, Colorado, northwestern New Mexico, northeastern Arizona, Nevada, extreme east-central California, southeastern Oregon, northeastern Washington, Idaho, except the southwestern portion, Montana, the Dakotas, Minnesota, Wyoming, and Utah, except the northwestern portion; —10° to —20° from the northern portions of Maine and Vermont, northwestern Wisconsin, Minnesota, north-central and extreme northwestern Iowa, northern Nebraska, the Dakotas, Montana, central and eastern Idaho, Wyoming, except southeastern portion, western Colorado, and portions of southeastern Utah, west central New Mexico, central Arizona, and northeastern Nevada; —20° to —30°, west-central Wisconsin, northern Minnesota, northeastern South Dakota, North Dakota, except south-central part, northeastern and north-central Montana, south-central Idaho, and central Arizona; and —30 from portions of northwestern Minnesota, southeastern North Dakota, and northeastern Montana.

The average temperatures for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	9	31.7	+ 6.7	....	....
Middle Atlantic	13	38.9	+ 6.4	....	....
South Atlantic	10	48.8	+ 2.8	....	....
Florida Peninsula*	8	60.6	+ 0.8	....	....
East Gulf	8	49.2	+ 0.8	....	....
West Gulf	7	49.5	+ 2.9	....	....
Ohio Valley and Tennessee	12	39.6	+ 5.8	....	....
Lower Lake	8	34.0	+ 8.7	....	....
Upper Lake	10	26.8	+ 8.7	....	....
North Dakota*	8	12.4	+ 7.4	....	....
Upper Mississippi Valley	13	27.8	+ 7.5	....	....
Missouri Valley	11	29.1	+ 8.8	....	....
Northern Slope	7	26.1	+ 8.6	....	....
Middle Slope	6	36.6	+ 7.6	....	....
Southern Slope*	6	41.3	+ 3.2	....	....
Southern Plateau*	13	39.0	+ 1.5	....	....
Middle Plateau*	8	25.0	+ 0.2	....	....
Northern Plateau*	12	29.7	+ 4.4	....	....
North Pacific	7	42.3	+ 3.1	....	....
Middle Pacific	5	49.8	+ 2.7	....	....
South Pacific	4	53.1	+ 2.6	....	....

* Regular Weather Bureau and selected cooperative stations.

In Canada.—Prof. R. F. Stupart says:

Temperatures below the average were reported from Yukon Territory and the extreme northern districts of British Columbia, but in all other portions of Canada the normal was exceeded, and in many localities to a very marked extent. In the Northwest Provinces the departure ranged from 4° to 12°, in Ontario from 7° to 10°, in Quebec from 7° to 9°, and in the Maritime Provinces from 3° to 9°.

PRECIPITATION.

The distribution of total monthly precipitation is shown on Chart IV.

The precipitation for the month was above the normal in southwestern Virginia, western North Carolina, South Carolina, Georgia, except the extreme northwestern part, Florida, except the extreme southeastern and western portions, northern Arkansas, Missouri, Illinois generally, northern Lower Michigan, Upper Michigan, Wisconsin, eastern and central Iowa, Minnesota, North Dakota, west-central Wyoming, southeastern Idaho, Nevada, California generally, and portions of northwestern Washington; elsewhere it was below normal. The greatest excesses ranged from + 2.3 to + 2.8 inches, and occurred in extreme western North Carolina, north-central Upper Michigan, northwestern Arkansas, and the east-central part of northern California. The greatest deficiencies ranged from — 2.0 to — 3.0 inches and were reported from southeastern Tennessee, northeastern Alabama, southwestern Louisiana, southeastern Texas, extreme northwestern Pennsylvania, and extreme northwestern Washington.

By geographic districts the precipitation for the month was normal in the South Atlantic States and middle Pacific region; above normal in the Florida Peninsula, upper Lake region, North Dakota, upper Mississippi and Missouri valleys, and the middle Plateau and south Pacific regions.

The total depth and the southern limit of snowfall are depicted on Chart VII, and the depth of snow on ground at end of month on Chart VIII.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	9	2.89	74	—1.0	....
Middle Atlantic	13	2.64	75	—0.9	....
South Atlantic	10	4.16	100	0.0	....
Florida Peninsula*	8	4.06	137	+1.1	....
East Gulf	8	4.09	77	—1.2	....
West Gulf	7	2.29	66	—1.2	....
Ohio Valley and Tennessee	12	3.02	72	—1.2	....
Lower Lake	8	1.54	58	—1.1	....
Upper Lake	10	2 76	124	+0.7	....
North Dakota*	8	0.84	156	+0.3	....
Upper Mississippi Valley	13	2.59	153	+0.9	....
Missouri Valley	11	1.24	119	+0.2	....
Northern Slope	7	0.36	55	—0.3	....
Middle Slope	6	0.46	61	—0.3	....
Southern Slope*	6	0.55	65	—0.3	....
Southern Plateau*	13	0.69	70	—0.3	....
Middle Plateau*	8	1.70	170	+0.7	....
Northern Plateau*	12	1.75	90	—0.2	....
North Pacific	7	6.31	84	—1.2	....
Middle Pacific	5	5.41	100	0.0	....
South Pacific	4	3.31	122	+0.6	....

*Regular Weather Bureau and selected cooperative stations.

In Canada.—Professor Stupart says :

Precipitation was deficient in most parts of Canada, except in northern, and locally in southern, parts of British Columbia, the eastern portion of Saskatchewan, in Manitoba, and in a few scattered localities in Ontario.

The depth of snow on the ground at the end of the month varied very much with the district. In the Cariboo district of British Columbia 18 inches were reported. In the Northwest Provinces the ground was practically bare in southwest districts, while there was a covering of from 3 to 9 inches elsewhere. In New Ontario the depth varied from 1 to 14 inches, while over the remainder of the province there was practically no snow in evidence. A depth of from 13 to 21 inches existed in Quebec and about 12 inches in northern New Brunswick, and over the southern portion of New Brunswick, Nova Scotia, and Prince Edward Island there was no snow.

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Atlanta, Ga.	21	50	se.	Mount Weather, Va.	16	56	nw.
Block Island, R. I.	6	51	w.	Do	17	60	nw.
Do	13	54	ne.	Do	23	56	nw.
Do	14	54	ne.	Do	24	58	nw.
Buffalo, N. Y.	4	50	w.	Nantucket, Mass.	13	58	ne.
Do	15	60	sw.	Do	14	67	ne.
Do	16	67	sw.	New York, N. Y.	6	61	w.
Do	23	57	sw.	North Head, Wash.	7	54	se.
Cairo, Ill.	3	52	sw.	Do	12	54	s.
Cape Henry, Va.	9	50	nw.	Do	16	60	s.
Do	12	52	n.	Do	21	60	s.
Do	13	54	n.	Do	22	60	se.
Do	26	50	ne.	Do	23	72	s.
Chicago, Ill.	3	56	sw.	Do	24	66	se.
Cleveland, Ohio	6	54	sw.	Oklahoma, Okla.	21	58	n.
Do	15	50	sw.	Do	22	60	nw.
Columbus, Ohio	6	50	sw.	Peoria, Ill.	3	53	s.
Do	15	56	sw.	Pittsburg, Pa.	6	51	w.
Do	16	52	sw.	Do	15	66	w.
Detroit, Mich.	15	52	sw.	Do	16	52	w.
Do	16	50	sw.	Point Reyes Light, Cal.	11	50	s.
Duluth, Minn.	5	50	w.	Do	12	67	sw.
Do	30	54	nw.	Do	13	57	sw.
Eastport, Me.	4	52	se.	Do	15	53	s.
Do	16	63	se.	Do	16	74	s.
Evansville, Ind.	15	50	s.	Do	17	51	sw.
Grand Haven, Mich.	4	51	sw.	Do	18	70	s.
Do	6	54	w.	Do	19	61	nw.
Do	16	50	w.	Reno, Nev.	16	58	sw.
Keokuk, Iowa	3	50	sw.	Richmond, Va.	4	51	s.
Lexington, Ky.	15	50	s.	St. Louis, Mo.	15	50	sw.
Little Rock, Ark.	21	50	nw.	Southeast Farallon, Cal.	11	54	s.
Mount Tamalpais, Cal.	1	50	n.	Do	16	55	s.
Do	12	61	sw.	Do	18	54	s.
Do	13	61	sw.	Syracuse, N. Y.	15	58	s.
Do	15	58	sw.	Do	16	57	s.
Do	16	60	sw.	Tatoosh Island, Wash.	4	54	s.
Do	17	54	s.	Do	7	50	sw.
Do	18	62	nw.	Do	10	64	e.
Do	19	75	nw.	Do	11	85	e.
Mount Weather, Va.	6	65	nw.	Do	23	54	s.
Do	9	52	nw.	Do	31	54	e.

HUMIDITY.

The average relative humidity for the month was normal in New England and the upper Lake region; below normal in the Middle Atlantic and Gulf States, Ohio Valley and Tennessee, lower Lake region, and the middle and southern slope and middle and southern Pacific regions; elsewhere it was above the normal.

The averages by districts appear in the following table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	76	0	Missouri Valley	76	+ 1
Middle Atlantic	74	− 2	Northern Slope	75	+ 5
South Atlantic	79	+ 2	Middle Slope	66	− 1
Florida Peninsula	84	+ 3	Southern Slope	64	− 2
East Gulf	75	− 3	Southern Plateau	54	+ 4
West Gulf	71	− 5	Middle Plateau	75	+ 5
Ohio Valley and Tennessee	73	− 4	Northern Plateau	84	+ 4
Lower Lake	77	− 4	North Pacific	88	+ 3
Upper Lake	83	0	Middle Pacific	76	− 3
North Dakota	81	+ 1	South Pacific	68	− 4
Upper Mississippi Valley	82	+ 4			

CLEAR SKY AND CLOUDINESS.

The cloudiness for the month was below average in the west Gulf States, lower Lake region, Missouri Valley, and south Pacific region; and above the average in all other districts, except North Dakota, where it was normal.

The distribution of clear sky is graphically shown on Chart V, and the numerical values of average daylight cloudiness, both for individual stations and by geographic districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the following table:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	6.0	+ 0.2	Missouri Valley	5.0	− 0.1
Middle Atlantic	6.2	+ 0.6	Northern Slope	5.2	+ 0.1
South Atlantic	6.0	+ 0.7	Middle Slope	4.2	+ 0.4
Florida Peninsula	6.2	+ 1.4	Southern Slope	4.2	+ 0.4
East Gulf	6.1	+ 0.5	Southern Plateau	3.8	+ 0.7
West Gulf	4.6	− 0.7	Middle Plateau	5.5	+ 1.4
Ohio Valley and Tennessee	6.5	+ 0.1	Northern Plateau	7.6	+ 0.1
Lower Lake	7.2	− 0.3	North Pacific	8.5	+ 1.0
Upper Lake	7.2	+ 0.4	Middle Pacific	5.8	+ 0.7
North Dakota	4.7	0.0	South Pacific	3.7	− 0.4
Upper Mississippi Valley	6.1	+ 0.8			

DESCRIPTION OF TABLES AND CHARTS.

By Mr. WM. B. STOCKMAN, Chief of the Division of Meteorological Records.

Table I gives the data ordinarily needed for climatological studies for about 145 Weather Bureau stations making simultaneous observations at 8 a. m. and 8 p. m., seventy-fifth meridian time daily, and for about 42 others making only one observation. The altitudes of the instruments above ground are also given.

Table II gives, for about 2800 stations occupied by cooperative observers, the absolute maximum and minimum temperatures of the month, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station, the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . . .).

Table III gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the direction resultants of the wind based on these two observations only and without considering the velocity. The total movement for the whole month is given for each station in Table I.

Table IV gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates per hour (inches)	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table V gives, for about 30 stations of the Canadian Meteorological Service, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table VI gives the heights of rivers referred to zeros of gages.

Chart I.—Hydrographs for seven principal rivers of the United States.

Chart II, tracks of centers of high areas, and Chart III, tracks of centers of low areas. The roman numerals show number and chronological order of the centers. The figures within the circles show the days of the month; the letters *a* and *p* indi-

cate, respectively, the observations at 8 a. m. and 8 p. m., seventy-fifth meridian time. Within each circle is also given (Chart II) the highest barometric reading and (Chart III) the lowest reading reported at or near the center at that time, and in both cases as reduced to sea level and standard gravity.

Chart IV.—Total precipitation. The scale of shades showing the depth is given on the chart. Where the monthly amounts are too small to justify shading, and over sections of the country where the stations are too widely separated, or the topography is too diversified to warrant reasonable accuracy in shading, the actual depths are given for a limited number of representative stations. Amounts less than 0.005 inch are indicated by the letter "T," and no precipitation by 0.

Chart V.—Percentage of clear sky. The average cloudiness at each Weather Bureau station is determined by numerous personal observations between sunrise and sunset. The difference between the observed cloudiness and 100 is assumed to represent the percentage of clear sky, and the values thus obtained are the basis of this chart, which does not relate to the nighttime.

Chart VI.—Isobars and isotherms at sea level and surface wind resultants. The pressures have been reduced to sea level and standard gravity by the method described by Prof. Frank H. Bigelow on pages 13–16 of the REVIEW for January, 1902. The pressures have also been reduced to the mean of the twenty-four hours by the application of a suitable correction to the mean of the 8 a. m. and 8 p. m. readings, at stations taking two observations daily, and to the 8 a. m. or 8 p. m. observation, respectively, at stations taking but a single observation. The diurnal corrections so applied will be found in Table 27, Volume II, Annual Report of the Chief of Weather Bureau, 1900–1901, pp. 140–164.

The isotherms on the sea-level plane have been constructed by means of the data summarized in chapter 8 of the Annual Report of the Chief of the Weather Bureau for 1900–1901, Volume II. The correction $t_0 - t$, or temperature on the sea-level plane minus the station temperature, as given by Table 48 of the above report, is added to the observed surface temperature to obtain the adopted sea-level temperature.

The wind direction resultants are computed from observations at 8 a. m. and 8 p. m. daily. The duration resultants are shown by figures attached to the arrows.

Chart VII.—Total snowfall. This is based on the reports from regular and cooperative observers, and shows the depth in inches and tenths of the snowfall during the month. In general, the depth is shown by lines inclosing areas of equal snowfall, but in special cases figures are also given.

Chart VIII.—Depth of snow on ground at the end of month, expressed in inches and tenths.

TABLE I.—*Climatological data for U. S. Weather Bureau stations, January, 1906.*

Stations.	Elevation of instruments: Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Pressure, in inches: Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Temperature of the air, in degrees Fahrenheit: Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches: Total.	Departure from normal.	Days with .01, or more.	Wind: Total movement, miles.	Prevailing direction.	Maximum velocity: Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
New England.							31.7	+ 6.7										76	2.89	− 1.0										6.0	
Eastport	76	69	85	29.98	30.07	+ .07	26.8	+ 6.4	50	24	34	0	10	19	34	25	22	80	3.36	− 0.6	10	9,932	nw.	63	se.	16	7	7	17	7.2	6.0
Portland, Me.	103	81	117	29.98	30.11	+ .06	29.2	+ 6.7	65	21	36	5	10	22	29	26	21	74	2.87	− 0.8	8	6,832	sw.	34	se.	16	9	13	9	5.2	3.8
Concord	288	70	79	29.78	30.11	+ .06	28.6	+ 7.6	64	23	37	3	11	20	38	.....	.....	.....	1.73	− 1.6	7	4,083	nw.	25	sw.	30	11	8	12	5.4	10.5
Northfield	876	16	70	29.12	30.11	+ .06	22.2	+ 6.7	56	21	32	−17	9	12	33	20	16	82	1.38	− 1.4	11	6,104	s.	34	nw.	28	5	9	17	6.7	9.6
Boston	125	115	188	29.97	30.12	+ .07	35.7	+ 8.7	68	23	43	9	10	28	35	31	26	70	2.96	− 1.1	12	8,222	sw.	33	ne.	14	10	7	14	5.7	6.1
Nantucket	12	14	90	30.09	30.10	+ .06	36.9	+ 5.5	56	23	42	13	10	32	21	34	31	81	4.93	+ 1.2	12	14,342	ne.	67	ne.	14	7	12	12	6.3	7.7
Block Island	26	11	46	30.08	30.12	+ .05	36.8	+ 5.7	56	22	42	13	10	32	24	34	30	77	3.03	− 1.2	12	15,523	sw.	54	ne.	13	5	16	10	6.2	3.5
Narragansett	.....	9	.....	.....	.....	.....	34.5	+ 5.7	56	23	42	2	10	26	27	.....	.....	.....	2.52	− 2.8	11	.....	w.	.....	.....	.....	9	9	13	.....	7.0
Providence	160	57	67	29.95	30.13	+ .07	34.2	.....	64	23	42	6	10	27	32	30	26	76	2.59	.....	10	5,837	w.	27	nw.	6	10	9	12	5.9	8.4
Hartford	159	122	132	29.95	30.13	+ .06	33.5	.....	60	23	41	5	10	26	27	30	24	71	2.69	.....	13	5,421	n.	31	sw.	30	10	9	12	5.5	4.7
New Haven	106	116	155	30.01	30.13	+ .05	35.0	+ 7.5	58	23	42	6	10	28	27	31	26	74	3.20	− 1.1	16	7,179	ne.	36	w.	6	12	4	15	5.7	5.5
Mid. Atlantic States.							38.0	+ 6.4										74	2.64	− 0.9										6.2	
Albany	97	102	115	30.02	30.13	+ .06	31.8	+ 8.6	64	23	39	5	10	24	29	28	24	75	0.97	− 1.9	10	6,412	s.	30	s.	15	7	10	14	6.4	2.5
Binghamton	875	79	90	29.14	30.10	+ .02	32.0	+ 9.6	70	21	40	5	10	24	32	.....	.....	.....	1.09	− 1.8	11	5,602	w.	32	w.	4	6	4	21	7.5	2.3
New York	314	108	350	29.78	30.13	+ .03	37.3	+ 6.8	63	23	43	13	10	32	20	34	30	74	2.98	− 1.1	13	10,451	w.	61	w.	6	8	9	14	6.1	3.0
Harrisburg	374	94	104	29.73	30.15	+ .05	36.5	+ 6.2	65	23	43	13	9	30	29	32	27	70	1.76	− 1.9	10	6,173	e.	44	w.	6	9	9	13	5.6	6.2
Philadelphia	117	116	184	30.02	30.15	+ .04	39.4	+ 7.4	71	23	46	15	9	33	23	35	29	69	3.16	− 0.2	15	8,612	nw.	35	n.	28	7	9	15	6.4	2.4
Scranton	805	111	119	29.23	30.12	+ .03	34.5	.....	68	23	42	6	10	27	32	30	27	77	1.37	.....	11	6,444	sw.	38	sw.	6	6	9	16	6.8	2.8
Atlantic City	52	37	48	30.08	30.14	+ .03	38.4	+ 5.9	53	31	44	13	10	33	23	35	32	79	2.48	− 1.3	13	7,460	ne.	36	ne.	13	7	5	19	6.9	4.1
Cape May	17	48	52	30.14	30.16	+ .04	39.1	+ 4.7	58	4	44	15	10	35	21	36	.....	.....	2.08	− 1.8	13	8,062	s.	32	nw.	6	7	10	14	6.1	1.0
Baltimore	123	69	117	30.00	30.14	+ .02	40.2	+ 6.2	64	22	47	17	9	33	20	35	29	70	3.22	− 0.1	12	6,436	nw.	46	w.	6	7	7	17	6.7	1.2
Washington	112	59	76	30.01	30.13	.00	40.0	+ 6.8	71	23	48	11	10	32	29	35	29	70	3.11	− 0.4	11	5,866	s.	38	w.	6	8	15	8	6.5	2.8
Cape Henry	18	11	58	30.10	30.13	.00	45.0	+ 4.8	76	23	52	26	9	38	28	.....	.....	.....	2.03	− 2.2	13	12,819	s.	54	n.	13	11	4	16	6.0	2.5
Lynchburg	681	83	88	29.38	30.14	+ .01	42.0	+ 5.2	71	22	50	20	10	34	31	38	34	77	4.08	+ 0.1	12	3,742	sw.	25	nw.	6	13	5	13	5.8	1.1
Mount Weather	1,725	10	57	28.25	30.14	+ .01	34.4	.....	64	22	41	7	9	28	31	30	25	72	2.77	.....	14	13,862	nw.	65	nw.	6	11	9	11	5.4	1.6
Norfolk	91	102	111	30.05	30.15	+ .02	46.2	+ 5.8	75	23	53	22	9	39	29	42	38	77	2.57	− 1.3	12	8,631	s.	49	sw.	4	11	4	16	6.2	1.0
Richmond	144	145	153	30.00	30.16	+ .03	43.1	.....	75	22	51	19	9	35	32	.....	.....	.....	2.54	.....	11	7,624	s.	51	s.	4	10	9	12	5.5	0.7
Wytheville	2,293	40	47	27.70	30.15	+ .01	37.9	+ 5.7	66	20	46	13	9	29	34	33	30	81	4.79	+ 1.8	11	4,999	w.	30	w.	6	12	8	11	5.1	8.0
S. Atlantic States.							48.8	+ 2.8										79	4.16	0.0										6.0	
Asheville	2,255	53	75	27.73	30.16	+ .01	40.4	+ 3.6	69	20	48	14	10	32	32	35	31	77	6.69	+ 2.3	12	7,766	se.	38	se.	22	12	7	12	5.5	16.7
Charlotte	773	68	76	29.29	30.15	.00	44.4	+ 3.2	72	21	52	26	10	37	26	39	34	72	6.34	+ 1.2	15	6,179	ne.	30	w.	16	8	10	13	6.2	
Hatteras	11	12	47	30.12	30.13	− .01	50.6	+ 4.9	71	21	57	30	9	44	27	46	44	85	4.29	− 1.6	11	12,681	ne.	45	n.	13	12	7	12	5.5	0.2
Raleigh	376	71	79	29.73	30.15	+ .02	45.7	+ 4.9	74	22	54	23	10	38	29	41	36	74	3.67	+ 0.1	9	6,038	n.	27	sw.	4	9	4	18	6.5	T.
Wilmington	78	81	91	30.04	30.12	− .02	49.9	+ 3.0	74	22	58	26	10	41	31	45	42	81	3.26	− 0.7	11	6,779	ne.	36	s.	3	12	5	14	5.9	0.1
Charleston	48	14	92	30.09	30.14	− .01	51.3	+ 1.3	71	23	58	32	10	45	24	47	44	84	3.65	− 0.4	12	8,458	e.	40	ne.	25	9	8	14	6.2	
Columbia, S. C.	351	41	57	29.75	30.14	− .01	48.3	+ 2.7	77	21	57	22	10	40	30	43	38	76	4.12	+ 0.3	13	6,224	ne.	31	sw.	22	9	9	13	6.1	T.
Augusta	180	89	97	29.95	30.14	− .02	48.8	+ 2.2	77	21	58	23	10	40	33	44	40	78	2.76	− 1.7	11	5,627	w.	28	w.	22	11	6	14	5.6	T.
Savannah	65	81	89	30.07	30.14	− .01	52.7	+ 1.7	76	18	61	30	10	44	27	47	41	80	3.39	+ 0.1	11	6,137	w.	27	s.	22	10	9	12	5.9	
Jacksonville	43	101	129	30.07	30.12	− .03	56.0	+ 0.8	80	22	63	37	10	48	26	51	49	85	3.46	+ 0.2	10	7,014	nw.	34	ne.	10	6	12	13	6.4	
Florida Peninsula.							65.0	+ 0.3										84	3.34	+ 0.5										6.2	
Jupiter	23	10	48	30.06	30.09	− .01	65.6	− 0.1	82	4	72	46	29	59	25	61	59	86	2.62	− 1.2	13	8,604	nw.	34	se.	21	5	17	9	6.3	
Key West	22	10	53	30.06	30.08	− .02	68.8	− 0.9	81	4	73	55	29	64	15	64	61	83	3.52	+ 1.4	9	8,168	ne.	36	w.	12	7	14	10	6.1	
Sand Key	25	40	71	30.04	30.07	− .03	69.0	.....	78	20	72	60	25	66	12	.....	.....	.....	1.97	.....	6	13,279	ne.	40	n.	23	4	13	14	6.7	
Tampa	35	79	96	30.08	30.12	.00	60.5	+ 1.8	82	19	68	41	10	53	28	55	53	84	3.88	+ 1.2	9	5,995	nw.	31	nw.	12	9	8	14	5.9	
East Gulf States.							49.2	+ 0.8										75	4.00	− 1.2										6.1	
Atlanta	1,174	190	216	28.87	30.13	− .02	45.0	+ 2.5	66	22	52	19	9	38	28	41	37	79	6.78	+ 1.1	14	10,724	nw.	50	se.	21	8	5	18	6.5	3.8
Macon	370	55	66	29.74	30.15	− .01	48.9	.....	73	21	58	25	10	40	31	.....	.....	.....	5.09	.....	12	3,943	ne.	34	sw.	22	5	8	18	7.3	2.4
Thomasville	273	8	57	29.85	30.15	− .01	51.8	.....	78	18	62	30	24	42	32	.....	.....	.....	3.87	.....	15	4,366	nw.	29	w.	3	7	8	16	6.4	
Pensacola	56	79	96	30.08	30.14	.00	51.4	− 1.1	69	22	58	29	24	44	27	.....	.....	.....	2.98	− 1.7	9	7,921	nw.	43	se.	21	10	6	15	6.1	
Anniston	741	8	58	29.35	30.16	.00	45.2	.....	71	20	55	20	9	35	34	.....	.....	.....	4.53	.....	13	5,340	se.	24	se.	22	6	7	18	7.0	T.
Birmingham	700	136	144	29.35	30.14	− .02	46.6	+ 0.9	70	20	54	19	9	39	30	.....	.....	.....	3.75	− 2.0	12	7,451	n.	36	se.	22	8	7	16	6.4	
Mobile	57	98	96	30.08	30.14	− .01	51.1	+ 0.6	75	18	60	29	9	43	31	46	41	73	3.73	− 1.4	8	4,734	nw.	26	s.	3	9	13	9	5.2	
Montgomery	223	100	112	29.90	30.16	.00	48.8	+ 0.5	75	20	58	24	9	40	31	44	40	78	4.91	− 0.5	11	5,661	se.	26	w.	22	9	5	17	6.2	
Meridian	375	84	93	29.73	30.14	− .02	47.0	0.0	75	20	57	22	9	37	38	.....	.....	.....	3.49	− 1.7	10	5,312	n.	27	w.	22	13	3	15	5.9	
Vicksburg	247	62	74	29.85	30.14	− .01	49.8	+ 2.5	78	20	58	24	23	41	30	44	38	68	4.53	− 1.0	9	6,261	n.	33	w.	3	14	7	10	4.8	T.
New Orleans	51	88	121	30.09	30.14	+ .01	54.0	+ 0.2	78	18	62	31	24	46	37	48	44	75	2.57	− 2.6	8	7,816	nw.	34	se.	21	12	7	12	5.3	
West Gulf States.							49.5	+ 2.9										71	2.29	− 1.2										4.6	
Shreveport	249	77	84	29.87	30.15	+ .01	48.9	+ 3.0	77	19	58	21	23	40	35	43	37	68	2.80	− 1.8	6	5,862	nw.	38	w.	21	15	2	14	5.2	0.2
Fort Smith	457	79	94	29.62	30.12	− .02	42.3	+ 6.2	75	20	52	10	23	32	35	36	31	72	4.81	+ 2.4	8	7,578	e.	37	w.	15	13	8	10	4.6	7.7
Little Rock	357	93	100	29.75	30.14	− .01	45.2	+ 4.4	74	20	54	17	23	36	31	39	34	70	4.39	− 0.5	9	6,378	nw.	50	nw.	21	15	6	10	4.5	0.2
Corpus Christi	20	48	53	30.12	30.14	+ .04	55.2	− 0.3	80	18	64	30	23	46	30	50	46	76	0.68	− 2.2	4	6,808	se.	36	nw.	2	12	11	8	4.6	
Fort Worth	670	106	114	29.40	30.13	+ .01	47.1	.....	77	17	60	17	9	35	40	.....	.....	.....	0.93	.....	6	8,080	nw.	36	nw.	22	14	14	3	4.0	3.3
Galveston	54	106	112	30.10	30.16	+ .03	53.2	+ 0.5	70	15	59	33	9	47	28	50	47	83	1.17	− 2.5	6	8,987	se.	49	nw.	3	13	7	11	4.9	T.
Palestine	510	73	79	29.58	30.12	.00	49.6	+ 5.8	79	20	60	21	9	39	41	43	37	68	1.92	− 2.4	5	7,080	s.	34	nw.	21	10	10	11	5.5	1.0
San Antonio	701	80	91	29.38	30.12	+ .02	52.4	+ 0.9	79	19	65	24	23	40	36	45	37	63	0.29	− 1.4	5	5,106	se.	38	n.	8	16	8	7	4.1	T.
Taylor	583	55	63	29.50	30.13	+ .02	50.2	.....	78	19	62	21	23	38	37	.....	.....	.....	0.61	.....	6	6,772	s.	33	nw.	21	16	5	10	4.3	T.
Ohio Val. and Tenn.							39.6	+ 5.8										73	3.02	− 1.2										6.5	
Chattanooga	762	106	112	29.33	30.16	.00	44.0	+ 3.0	69	20	52	19	9	36	30	39	34	70	3.32	− 2.9	15	6,315	se.	31	sw.	15	9	6	16	6.3	5.3
Knoxville	1,004	35	88	29.06	30.14	− .01	42.2	+ 4.5	71	20	51	17	9	33	34	37	32	73	3.60	− 1.9	11	6,503	sw.	44	sw.	4	8	8	15	6.1	0.2
Memphis	399	76	97	29.72	30.15	− .01	44.9	+ 5.0	74	20	53	18	9	37	31	40	36	75	5.30	− 0.2	9	8,034	n.	48	sw.	15	10	9	12	5.7	0.2
Nashville	546	79	91	29.56	30.15	− .01	43.1	+ 4.7	72	20	52	17	9	34	32	37	31	68	3.26	− 1.8	10	5,888	w.	50	sw.	15	7	7	17	6.5	0.2
Lexington	989	75	102	29.04	30.14	+ .01	37.1	+ 4.3	72	20	45	6	9	30	30	.....	.....	.....	2.29	− 1.5	11	10,101	se.	50	s.	15	7	6	18	6.6	5.5
Louisville	525	111	132	29.54	30.14	.00	39.8	+ 5.7	73	20	48	10	9	32	34	35	30	71	2.68	− 1.3	9	7,796	sw.	46	sw.	15	6	9	16	6.5	2.4
Evansville	431	72	82	29.64	30.12	− .02	39.0	.....	71	20	47	11	9	32	32	.....	.....	.....	4.76	.....	8	6,884	s.	50	s.	15	7	15	9	6.0	3.8
Indianapolis	822	154	164	29.18	30.09	− .03	35.3	+ 7.0	70	20	43	8	9	28	30	32	28	78	2.36	− 0.6	12	9,730	s.	47	s.	3	3	9	19	7.5	1.6
Cincinnati	628	152	160	29.42	30.13	+ .01	38.2	+ 5.7	75	21	46	7	9	31	26	34	28	69	3.25	− 0.2	12	6,342	se.	41	sw.	15	8	6	17	6.6	6.1
Columbus	824	173	190	29.20	30.10	− .01	36.6	+ 8.2	72	21	44	4	9	29	24	32	28	76	1.98	− 1.3	12	9,503	sw.	56	sw.	15	9	5	17	6.4	5.4
Pittsburg	842	336	352	29.19	30.12	+ .01	38.4	+ 7.8	75	22	46	11	9	31	38	33	27	68	1.84	− 1.3	12	9,669	w.	66	w.	15	4	7	20	7.4	3.5
Parkersburg	638	77	84	29.46	30.13	+ .03	39.3	+ 6.3	74	21	48	10	10	31	30	34	30	76	2.55	− 1.0	12	5,406	w.	34	w.	6	6	7	18	6.5	2.2
Elkins	1,940	41	50	28.03	30.16	+ .06	36.6	+ 6.8	73	22	47	− 4	10	27	47	32	28	78	3.84	− 0.1	18	4,112	w.	32	s.	22	7	9	15	6.7	6.2
Lower Lake Region.							34.0	+ 8.7										77	1.54	− 1.1										7.2	
Buffalo	767	178	206	29.19	30.05	− .02	33.4	+ 9.0	70	22	40	7	8	27	33	30	26	76	2.17	− 0.8	17	14,553	sw.	67	sw.	16	5	8	18	7.3	9.8
Oswego	335	76	91	29.69	30.07	.00	30.8	+ 6.5	69	22	38	4	10	24	31	29	26	81	2.27	− 0.7	15	10,440	s.	46	nw.	6	5	5	21	7.7	13.0
Rochester	523	81	102	29.49	30.08	+ .01	33.2	+ 9.3	71	21	40	5	9	27	31	28	25	74	1.34	− 1.8	14	8,265	w.	36	w.	4	7	5	19	7.2	7.6
Syracuse	597	97	113	29.42	30.08	+ .01	31.6	.....	68	23	39	5	8	24	34	.....	.....	.....	2.16	.....	15	9,660	s.	58	s.	15	6	10	15	6.3	13.3
Erie	713	92	102	29.27	30.06	− .02	35.3	+ 8.4	72	22	41	12	8	29	34	31	26	71	1.09	− 2.2	16	10,895	sw.	46	sw.	16	6	3	22	7.6	4.4
Cleveland	762	190	201	29.22	30.06	− .03	35.4	+ 9.2	71	22	42	12	9	29	35	32	29	79	1.59	− 0.9	15	13,652	sw.	54	sw.	6	6	6	19	7.1	10.0
Sandusky	629	62	70	29.37	30.07	− .02	36.0	+ 9.5	72	21	42	14	9	30	32	.....	.....	.....	0.93	− 1.3	8	7,073	sw.	36	sw.	15	7	7	17	6.6	1.9
Toledo	628	120	127	29.36	30.06	− .03	34.7	+ 8.6	70	21	42	13	9	28	32	31	27	77	0.99	− 1.1	12	9,618	sw.	54	sw.	15	7	5	19	7.1	2.1
Detroit	730	153	193	29.23	30.05	− .03	33.6	+ 9.1	65	21	40	12	9	28	29	31	28	83	1.90	0.0	13	10,491	sw.	52	sw.	15	5	6	20	7.5	7.3
Upper Lake Region.							26.8	+ 8.7										83	2.76	+ 0.7										7.2	
Alpena	609	13	92	29.30	29.99	− .05	27.8	+ 9.7	50	29	34	7	25	22	23	26	23	86	2.95	+ 0.5	17	9,161	nw.	35	se.	3	4	12	15	7.1	15.6
Escanaba	612	40	48	29.30	29.99	− .06	23.6	+ 6.9	40	20	30	2	24	17	26	22	19	83	3.42	+ 1.8	15	6,147	sw.	31	n.	16	7	4	20	7.5	20.9
Grand Haven	632	54	92	29.30	30.00	− .07	31.5	+ 7.3	58	20	37	14	8	26	24	30	27	84	3.72	+ 1.1	12	11,958	sw.	54	sw.	6	4	8	19	7.3	10.8

TABLE I.—*Climatological data for U. S. Weather Bureau stations, January, 1906*—Continued.

Stations.	Elevation of instruments. Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Temperature of the air, in degrees Fahrenheit. Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches. Total.	Departure from normal.	Days with .01, or more.	Wind. Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
Up. Lake Reg—Con't.																															
Grand Rapids	707	127	165	29.22	30.02	−.04	31.6	+ 7.8	64	20	38	12	8	26	29	30	27	85	2.93	0.0	13	10,495	s.	48	sw.	4	3	8	20	7.8	5.6
Houghton	668	66	74	29.23	29.99	−.06	23.0	......	50	29	30	− 3	25	16	38	....	....	....	2.42	......	18	5,859	nw.	32	w.	29	3	5	23	8.2	26.2
Marquette	734	77	116	29.15	29.97	−.07	24.2	+ 8.2	45	26	30	4	8	18	28	22	20	82	4.72	+ 2.7	18	9,252	w.	42	s.	29	2	10	19	7.8	46.0
Port Huron	638	70	120	29.32	30.03	−.03	31.8	+10.0	62	21	38	10	8	26	25	29	26	81	1.77	− 0.3	14	10,195	sw.	40	sw.	4	8	2	21	7.3	7.5
Sault Ste. Marie	614	40	61	29.27	29.99	−.04	22.0	+ 7.7	40	20	29	− 5	8	15	36	21	18	85	2.06	+ 0.3	22	8,055	nw.	44	w.	6	1	9	21	8.4	15.6
Chicago	823	140	310	29.13	30.04	−.06	32.6	+ 9.2	63	20	39	11	9	26	31	30	28	82	1.67	− 0.5	11	12,998	sw.	56	sw.	3	8	6	17	6.6	2.9
Milwaukee	681	122	142	29.26	30.03	−.05	29.0	+ 9.6	61	20	36	6	8	22	30	27	23	79	2.76	+ 0.6	12	7,873	w.	42	e.	3	9	3	19	6.5	10.8
Green Bay	617	49	86	29.30	29.99	−.07	24.1	+ 9.9	47	20	32	0	9	17	24	22	19	81	2.58	+ 0.7	13	8,352	sw.	37	n.	23	7	5	19	7.0	17.2
Duluth	1,138	11	47	28.72	30.00	−.09	16.8	+ 6.8	46	27	26	−12	22	8	38	15	13	84	1.78	+ 0.7	13	10,591	nw.	54	nw.	30	8	12	11	5.7	18.5
North Dakota.							12.4	+ 9.9										81	1.05	+ 0.4										4.7	
Moorhead	940	8	57	29.01	30.08	−.06	12.0	+12.9	38	26	22	−26	22	2	42	10	9	91	1.62	+ 0.9	9	7,148	nw.	30	nw.	5	15	6	10	4.7	15.9
Bismarck	1,674	15	57	28.22	30.10	−.03	13.7	+ 9.2	40	26	22	−18	22	5	35	11	4	67	0.71	+ 0.2	5	7,361	nw.	38	nw.	29	13	14	4	4.4	7.1
Devils Lake	1,482	11	44	28.39	30.06	−.06	9.6	......	38	31	20	−27	22	0	41	8	5	81	1.01	......	6	10,329	w.	48	w.	5	13	6	12	5.2	10.1
Williston	1,875	14	44	27.98	30.06	−.05	11.5	+ 7.6	42	4	22	−24	16	1	41	11	8	86	0.82	+ 0.2	6	6,858	w.	37	w.	29	17	5	9	4.5	8.3
Upper Miss. Valley.							27.8	+ 7.5										82	2.59	+ 0.9										6.1	
Minneapolis	......	102	208	......	......	......	20.0	+ 8.1	46	28	28	− 8	22	12	41	....	....	....	1.55	+ 0.7	6	10,077	w.	42	w.	5	7	11	13	....	17.7
St. Paul	837	171	179	29.08	30.02	−.09	19.6	+ 9.0	46	26	28	−11	8	11	40	19	16	83	1.20	+ 0.2	7	8,783	nw.	42	nw.	3	8	9	14	6.7	11.9
La Crosse	714	71	87	29.23	30.04	−.07	22.8	+ 8.1	47	29	32	− 9	8	14	31	....	....	....	1.76	+ 0.5	9	6,496	n.	34	nw.	5	10	4	17	6.4	13.7
Madison	974	70	78	28.92	30.02	−.08	24.4	+ 7.9	53	20	32	− 2	8	16	32	22	20	84	2.80	+ 1.1	12	9,147	nw.	39	n.	22	8	10	13	6.1	13.6
Charles City	1,015	8	58	28.91	30.04	−.10	19.4	+ 2.9	44	29	29	−19	8	10	32	18	17	92	1.99	+ 1.0	6	7,303	nw.	40	nw.	15	9	7	15	6.3	18.5
Davenport	606	71	79	29.37	30.05	−.07	28.4	+ 8.4	63	20	36	1	8	20	32	26	23	83	2.14	+ 0.5	9	7,012	nw.	35	nw.	15	12	3	16	6.1	8.3
Des Moines	861	84	101	29.13	30.07	−.07	27.2	+ 9.7	54	20	36	− 8	8	18	35	25	22	80	2.07	+ 0.7	4	7,044	nw.	29	nw.	15	10	9	12	5.9	18.1
Dubuque	698	100	117	29.27	30.06	−.06	25.2	+ 7.9	59	20	34	− 4	8	16	32	24	22	86	2.72	+ 1.0	9	6,105	nw.	31	nw.	15	11	7	13	5.9	7.5
Keokuk	614	63	78	29.38	30.09	−.05	31.6	+ 8.4	69	20	40	1	8	23	46	28	24	80	2.40	+ 0.7	7	7,139	sw.	50	sw.	3	14	3	14	5.4	6.6
Cairo	356	87	93	29.74	30.13	−.03	40.3	+ 5.6	74	20	48	13	9	32	29	36	32	76	6.17	+ 2.4	9	8,263	s.	52	sw.	3	9	5	17	6.3	1.2
La Salle	536	56	64	29.48	30.07	−.04	29.7	......	63	20	38	5	9	22	34	....	....	....	2.15	......	7	7,830	w.	47	sw.	3	9	7	15	6.4	5.7
Peoria	609	11	45	29.38	30.07	−.05	30.2	......	65	20	39	4	9	22	39	....	....	....	1.70	......	8	8,575	s.	53	s.	3	12	4	15	6.0	3.1
Springfield, Ill.	644	10	92	29.36	30.07	−.06	33.1	+ 7.6	71	20	41	8	9	25	38	30	27	82	2.99	+ 0.9	8	8,533	s.	46	sw.	15	8	7	16	6.3	3.4
Hannibal	534	75	109	29.48	30.07	−.06	33.0	+ 7.1	70	20	42	5	8	24	49	....	....	....	2.28	0.0	7	8,583	sw.	44	sw.	3	12	4	15	5.7	5.6
St. Louis	567	208	217	29.46	30.09	−.05	36.8	+ 6.3	72	20	45	11	9	29	41	33	28	72	3.57	+ 1.4	6	9,547	s.	50	sw.	15	13	6	12	5.4	5.0
Missouri Valley.							29.1	+ 8.8										76	1.24	+ 0.2										5.0	
Columbia, Mo.	784	11	84	29.24	30.09	−.04	34.2	+ 3.6	72	20	44	4	8	24	48	....	....	....	3.94	+ 1.7	8	7,468	s.	38	sw.	15	17	2	12	4.6	15.7
Kansas City	963	78	95	29.05	30.11	−.04	34.2	+ 8.8	69	20	42	5	8	26	36	30	26	74	1.41	+ 0.2	6	7,129	s.	33	s.	20	13	7	11	4.7	6.3
Springfield, Mo	1,324	98	104	28.65	30.10	−.04	36.7	+ 4.4	70	20	46	3	23	27	41	32	27	73	4.29	+ 1.8	9	9,276	se.	39	w.	15	14	7	10	4.7	8.9
Iola	984	40	47	29.03	30.11	−.03	35.2	......	68	19	45	8	8	26	34	....	....	....	1.36	......	6	6,925	sw.	32	n.	22	12	3	16	5.7	6.6
Topeka	.....	85	89	......	......	......	34.2	+ 7.4	71	20	44	5	8	24	43	....	....	....	0.63	− 0.4	5	7,227	s.	36	s.	19	13	7	11	4.7	3.6
Lincoln	1,189	11	84	28.76	30.07	−.08	31.0	+ 8.9	61	31	41	− 2	8	21	40	27	23	75	0.49	− 0.2	5	8,886	s.	41	nw.	15	11	9	11	5.3	6.3
Omaha	1,105	115	121	28.85	30.08	−.07	30.2	+11.0	58	29	39	− 3	8	22	35	26	21	69	0.60	− 0.1	6	7,530	n.	35	nw.	15	11	7	13	5.6	6.2
Valentine	2,598	47	54	27.27	30.08	−.04	27.4	+10.5	65	19	40	−18	22	15	51	23	19	74	0.52	− 0.1	7	7,252	nw.	40	nw.	17	14	11	6	4.7	6.1
Sioux City	1,135	96	164	28.79	30.05	−.10	26.4	+10.1	57	31	36	− 7	8	17	42	....	....	....	0.50	− 0.1	4	11,004	nw.	47	nw.	18	13	8	10	4.9	6.2
Pierre	1,572	43	50	28.37	30.12	−.01	21.2	+ 8.5	55	31	31	−19	22	12	40	18	15	80	0.37	− 0.1	3	4,716	nw.	47	nw.	17	14	7	10	4.6	5.0
Huron	1,306	56	67	28.64	30.10	−.06	19.4	+12.4	51	28	30	−21	22	8	41	17	14	84	0.37	− 0.1	5	8,586	nw.	40	nw.	17	13	10	8	4.6	4.0
Yankton	1,233	49	57	28.69	30.06	−.10	25.6	+11.4	62	26	36	−11	8	15	45	....	....	....	0.48	− 0.1	6	7,270	nw.	35	nw.	18	10	7	14	5.8	6.3
Northern Slope.							26.1	+ 8.6										75	0.36	− 0.3										5.2	
Havre	2,505	11	44	27.29	30.03	−.07	19.4	+ 9.7	53	24	29	−24	21	10	57	17	14	82	0.17	− 0.7	7	6,812	w.	48	sw.	4	7	18	6	5.5	1.7
Miles City	2,371	26	48	27.46	30.11	−.01	24.6	+14.0	52	31	35	−17	21	14	44	20	17	78	0.19	− 0.4	5	3,739	sw.	29	n.	17	12	13	6	4.7	1.8
Helena	4,110	8	56	25.77	30.08	−.07	27.8	+10.7	52	31	36	1	20	19	33	25	20	70	0.64	− 0.7	5	5,165	w.	46	w.	3	7	12	12	6.5	7.6
Kalispell	2,962	8	34	26.92	30.08	−.04	26.2	......	47	31	34	1	21	18	28	24	22	85	1.14	......	13	2,486	nw.	24	sw.	16	3	4	24	8.3	11.2
Rapid City	3,234	46	50	26.56	30.09	−.01	30.2	+10.0	62	31	43	− 5	22	18	46	26	22	78	0.06	− 0.3	2	5,646	w.	47	n.	16	17	7	7	3.5	0.6
Cheyenne	6,088	56	64	23.95	30.07	+.02	30.8	+ 5.8	61	28	44	− 6	2	18	45	24	15	54	0.21	− 0.2	5	9,512	nw.	45	nw.	17	16	11	4	3.7	2.4
Lander	5,372	26	36	24.63	30.22	+.10	17.0	− 2.9	50	18	31	−14	21	2	46	15	12	82	0.63	+ 0.2	5	2,125	sw.	34	sw.	16	6	20	5	5.1	6.8
Yellowstone Park	6,200	11	48	23.84	30.17	+.03	22.3	......	44	30	31	− 5	21	14	32	19	14	70	1.48	......	12	6,839	s.	38	nw.	16	8	8	15	6.1	18.8
North Platte	2,821	11	51	27.07	30.10	−.02	32.6	+12.6	66	31	48	− 1	8	17	49	25	20	73	0.61	+ 0.1	4	5,570	nw.	37	nw.	4	18	7	6	3.5	6.1
Middle Slope.							36.6	+ 7.6										66	0.46	− 0.3										4.2	
Denver	5,291	129	136	24.69	30.05	.00	36.6	+ 8.4	68	31	51	− 1	21	22	42	28	17	50	0.17	− 0.4	2	6,101	s.	44	sw.	15	12	15	4	3.9	4.8
Pueblo	4,685	80	86	25.27	30.05	.00	35.0	+ 6.3	65	31	50	0	3	20	45	28	19	56	0.36	0.0	4	5,720	nw.	42	w.	17	18	12	1	2.7	4.3
Concordia	1,398	42	47	28.58	30.10	−.04	33.8	+10.6	64	31	44	3	8	24	37	29	25	77	0.42	− 0.2	6	5,246	s.	28	nw.	15	16	6	9	4.3	3.1
Dodge	2,509	44	54	27.41	30.08	−.03	37.8	+11.2	73	19	51	5	22	24	46	31	26	73	0.40	0.0	3	7,521	nw.	37	se.	12	13	14	4	4.5	4.0
Wichita	1,358	78	86	28.64	30.12	−.01	36.4	+ 5.8	71	20	47	8	8	26	44	31	25	69	0.53	− 0.4	5	7,262	s.	32	n.	21	14	9	8	4.6	3.1
Oklahoma	1,214	79	86	28.78	30.10	−.01	40.0	+ 3.0	74	19	51	12	22	29	36	34	28	68	0.89	− 0.6	3	11,010	s.	60	nw.	22	15	6	10	4.9	1.0
Southern Slope.							43.0	+ 5.7										64	0.36	− 0.4										4.2	
Abilene	1,738	45	54	28.29	30.13	+.04	47.3	+ 4.5	82	19	60	16	9	34	38	38	29	60	0.32	− 0.6	3	6,512	s.	35	n.	21	9	16	6	4.7	1.3
Amarillo	3,676	10	49	26.28	30.08	+.02	38.8	+ 6.9	66	29	51	14	22	27	38	32	26	68	0.41	− 0.3	6	9,499	sw.	47	w.	14	14	5	12	4.6	3.0
Del Rio	944	8	57	29.11	30.12	+.06	51.0	......	85	18	67	18	23	35	45	....	....	....	0.01	......	1	5,349	se.	36	nw.	21	18	9	4	3.3	T.
Roswell	3,578	9	57	26.39	30.11	+.07	39.2	......	79	19	56	10	2	22	45	31	23	64	0.53	......	3	4,314	nw.	32	nw.	3	14	11	6	4.4	5.3
Southern Plateau.							41.0	+ 0.8										54	0.89	0.0										3.8	
El Paso	3,762	10	110	26.27	30.12	+.11	42.9	− 1.6	76	19	55	18	23	30	41	33	23	55	0.87	+ 0.3	5	7,855	nw.	48	sw.	20	11	14	6	4.8	6.5
Santa Fe	7,013	33	39	23.25	30.18	+.14	28.8	+ 0.9	52	27	40	0	22	18	33	22	14	58	0.35	− 0.2	5	5,840	ne.	34	sw.	19	17	13	1	2.9	5.9
Flagstaff	6,907	12	44	23.35	30.11	+.06	25.4	− 1.2	47	16	39	−20	2	12	46	22	17	73	0.86	− 1.2	7	4,585	e.	29	sw.	14	15	5	11	4.5	8.7
Phoenix	1,108	50	56	28.92	30.09	+.06	51.2	+ 1.4	76	27	64	24	2	38	37	42	31	50	0.35	− 0.4	2	2,882	e.	19	e.	8	12	15	4	4.1	
Yuma	141	16	46	29.95	30.10	+.05	54.8	+ 0.6	78	30	67	28	2	42	32	44	30	43	0.02	− 0.4	1	4,255	n.	27	n.	8	23	8	0	2.0	
Independence	3,910	11	42	26.06	30.10	+.03	43.0	+ 4.8	69	16	54	21	9	32	33	34	23	48	2.89	+ 1.7	6	6,215	nw.	37	n.	1	14	14	3	4.3	
Middle Plateau.							28.9	+ 0.5										77	1.60	+ 0.5										5.5	
Reno	4,532	56	63	25.52	30.16	+.03	34.6	+ 3.8	55	24	45	9	2	24	32	31	27	77	3.55	+ 2.0	7	4,106	sw.	58	sw.	16	10	9	12	5.2	8.7
Winnemucca	4,344	18	56	25.69	30.21	+.05	26.6	− 0.4	49	18	37	− 3	2	16	34	25	22	80	2.18	+ 1.1	10	6,150	ne.	39	sw.	16	10	6	15	6.0	15.7
Modena	5,479	10	43	24.66	30.15	+.05	28.5	− 0.6	50	17	39	− 8	2	18	38	22	19	70	0.67	0.0	4	6,823	w.	42	nw.	19	10	9	12	5.6	1.5
Salt Lake City	4,366	105	110	25.71	30.21	+.06	28.3	+ 0.4	50	16	35	7	1	22	28	26	22	76	1.19	− 0.2	9	4,220	se.	42	nw.	19	5	6	20	7.5	8.2
Durango	6,546	18	56	23.67	30.20	+.15	24.6	......	53	27	38	−13	3	11	42	19	15	73	1.99	......	8	3,772	nw.	27	sw.	20	16	6	9	4.1	17.5
Grand Junction	4,608	43	51	25.49	30.20	+.14	26.3	− 0.7	53	14	38	1	9	14	31	22	18	76	0.40	− 0.2	4	2,347	nw.	20	sw.	14	15	8	8	4.4	4.0
Northern Plateau.							31.1	+ 4.5										84	1.50	− 0.5										7.6	
Baker City	3,471	52	58	26.51	30.20	+.04	25.1	+ 2.3	43	25	31	3	21	19	23	24	21	83	1.51	− 0.1	11	4,200	s.	22	se.	13	5	9	17	7.0	14.8
Boise	2,739	78	86	27.30	30.26	+.07	30.6	+ 3.2	50	16	37	6	8	24	23	28	25	81	2.02	− 0.3	12	3,965	se.	28	se.	12	3	5	23	7.9	7.6
Lewiston	757	10	51	29.26	30.09	−.05	37.2	+ 2.0	53	31	43	17	1	32	19				0.58	− 0.7	6	4,538	e.	42	w.	16	2	8	21	8.1	2.8
Pocatello	4,477	46	54	25.56	30.25	+.05	24.8	+ 5.7	45	19	32	− 2	8	17	28	23	20	82	2.30	+ 1.3	8	7,662	e.	38	sw.	19	8	8	15	6.3	12.8
Spokane	1,929	101	110	28.00	30.12		30.8	+ 6.3	46	23	36	7	1	25	19	30	28	89	1.69	− 0.8	16	4,020	ne.	36	sw.	16	0	4	27	9.2	8.3
Walla Walla	1,000	71	79	29.01	30.11	−.04	38.1	+ 7.6	60	24	44	20	14	32	25	36	34	84	0.89	− 1.5	7	4,615	s.	30	s.	22	3	14	14	6.9	4.1
N. Pac. Coast Reg.							42.5	+ 3.1										88	6.31	− 1.2										8.5	
North Head	211	11	56	29.79	30.02	−.03	44.2	+ 3.3	55	31	48	32	5	40	17	43	42	92	7.61	− 0.9	26	13,064	e.	72	s.	23	2	7	22	8.1	0.9
Port Crescent	259	12	29	29.70	29.99	−.05	39.6	+ 4.1	55	23	44	26	*	35	18				5.46	− 1.6	26	3,784	se.	23	sw.	16	1	7	23	8.1	15.3
Seattle	123	185	224	29.92	30.05	.00	42.4	+ 1.5	57	24	46	31	7	39	13	41	39	89	5.03	+ 0.5	25	7,092	se.	36	sw.	16	0	4	27	9.2	4.1
Tacoma	213	113	120	29.80	30.04	.00	41.4	+ 3.4	57	23	46	29	7	37	16				5.83	− 0.6	25	4,615	sw.	26	sw.	16	0	2	29	9.4	2.4
Tatoosh Island	86	7	57	29.85	29.95	−.03	42.7	+ 2.1	52	24	46	32	19	40	14	41	39	87	9.70	− 3.0	26	14,591	e.	85	e.	11	0	8	23	8.6	4.8
Portland, Oreg.	153	68	96	29.90	30.06	−.02	43.0	+ 4.6	56	24	47	31	18	38	16	41	40	87	5.72	− 1.4	26	4,270	se.	29	sw.	16	1	6	24	8.7	T.
Roseburg	510	9	57	29.52	30.08	−.02	42.6	+ 2.3	62	24	48	29	19	37	20	41	39	87	4.81	− 1.4	15	1,980	s.	24	s.	16	6	7	18	7.1	0.2

TABLE I.—*Climatological data for U. S. Weather Bureau stations, January, 1906*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
Mid. Pac. Coast Reg.							49.8	+ 2.7											76	5.41	0.0										5.8	
Eureka	62	62	80	30.02	30.09	— .01	48.2	+ 2.2	68	24	54	31	1	42	21	45	42	82	7.63	0.0	16	4,770	se.	43	sw.	16	7	6	18	6.7	
Mount Tamalpais	2,375	11	18	27.61	30.09	— .02	47.0	....	62	31	51	32	1	42	15	42	37	70	4.65	....	11	15,339	n.	75	nw.	19	12	4	15	5.7	
Point Reyes Light	490	7	18	29.54	30.06	— .06	51.7	+ 3.1	69	30	56	43	21	47	20	....	....	....	2.52	— 3.5	12	14,665	n.	74	s.	16	9	7	15	6.2	
Red Bluff	332	50	56	29.75	30.12	.00	48.6	+ 3.7	73	29	57	30	20	40	32	44	39	74	6.38	+ 1.7	12	4,356	n.	38	s.	16	13	3	15	5.9	
Sacramento	69	106	117	30.04	30.12	.00	48.7	+ 3.1	65	30	56	32	2	42	25	46	42	79	6.63	+ 2.8	11	6,391	se.	45	se.	18	15	2	14	4.9	
San Francisco	155	161	167	29.97	30.14	+ .03	51.6	+ 1.5	68	31	57	41	7	46	24	48	44	77	3.90	— 0.8	10	5,405	nw.	36	sw.	13	11	7	13	5.8	
San Jose	141	78	88	29.97	30.12	....	50.0	....	73	31	60	32	7	40	34	....	....	....	2.86	....	12	3,804	se.	27	se.	16	15	5	11	4.7	
Southeast Farallon	30	9	17	30.07	30.10	....	51.7	....	63	31	54	45	19	49	12	....	....	....	2.96	....	12	11,310	nw.	55	s.	16	10	6	15	6.2	
S. Pac. Coast Reg.							53.1	+ 2.6										68	3.31	+ 0.6										3.7	
Fresno	330	67	70	29.78	30.15	+ .05	48.8	+ 4.3	69	25	59	28	1	39	30	45	40	75	2.05	+ 0.7	7	3,543	se.	24	nw.	19	17	4	10	4.5	
Los Angeles	338	116	123	29.74	30.11	+ .03	55.8	+ 2.7	82	31	66	34	2	46	32	48	40	61	3.85	+ 0.9	7	3,729	ne.	24	n.	1	18	3	10	3.6	
San Diego	87	94	102	30.00	30.10	+ .03	54.6	+ 1.0	72	26	62	35	1	47	22	48	42	69	0.98	— 1.0	4	3,290	nw.	29	s.	19	20	4	7	3.2	
San Luis Obispo	201	47	54	29.91	30.14	+ .05	53.3	+ 2.2	81	31	65	26	2	42	38	47	41	70	6.37	+ 1.7	8	3,640	n.	20	n.	20	19	5	7	3.6	
West Indies.																															
Grand Turk	11	6	20	30.05	30.06	+ .03	77.4	......	86	*	83	62	28	72	....	....	....	....	0.78	....	8	....	se.	....	......	....	....	....	....	....	
San Juan	82	48	90	29.94	30.03	+ .01	75.2	— .01	85	12	81	66	29	70	16	69	67	78	1.44	— 1.5	17	8,135	e.	31	e.	8	14	17	0	4.1	

* More than one date.

TABLE II.—*Climatological record of cooperative observers, January, 1906.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Temperature. (Fahrenheit.) Minimum.	Temperature. (Fahrenheit.) Mean.	Precipitation. Rain and melted snow.	Precipitation. Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alaga	......	......	......	6.94	
Ashville	72	20	46.0	4.70	T.
Benton	......	......	......	3.89	
Bermuda	77	26	49.2	2.76	
Boligee	75	23	47.7	4.46	T.
Bridgeport	......	......	......	3.88	T.
Burkeville	......	......	......	4.84	
Calera	......	......	......	4.28	
Cedar Bluff	......	......	......	5.61	
Citronelle	80	25	52.4	4.05	
Clanton	73	20	46.8	4.41	4.0
Cordova	......	......	......	6.23	
Dadeville	......	......	......	5.66	T.
Daphne	74	27	52.7	2.66	
Decatur	72	17	46.8	6.90	
Demopolis	......	......	......	4.30	
Eufaula	74	25	46.9	5.59	0.5
Evergreen	77	26	50.8	3.92	
Flomaton	76	26	52.6	4.37	
Florence	73	17	44.8	3.45	
Fort Deposit	74	25	47.4	5.57	
Gadsden	80	20	47.3	3.58	
Goodwater	75	20	47.0	5.89	T.
Greensboro	73	22	47.6	4.47	
Greenville	......	......	......	5.65	
Guntersville	......	......	......	3.84	T.
Hamilton	......	......	......	3.09	T.
Highland Home	75	24	49.4	3.46	
Letohatchie	......	......	......	5.63	
Livingston	74	23	46.3	5.45	
Lock No. 4	73	19	46.8	4.72	
Lucy	80	24	50.8	7.72	
Madison Station	70	16		6.37	
Maplegrove	74	21	44.1	4.82	
Marion	74	23	46.8	4.40	
Milstead	......	......	......	4.72	
Newbern	75	23	47.8	3.63	
Oneonta	72	16	44.8	5.01	T.
Opelika	70	23	47.1	3.86	T.
Ozark	......	......	......	6.57	T.
Prattville	78	23	48.4	4.30	
Riverton	76	18	45.0	3.90	
Scottsboro	75	19	45.2	3.55	T.
Selma	79	20	48.3	3.50	
Springhill	71	28	52.4	3.33	
Talladega	71	19	44.8	2.85	
Tallassee	......	......	......	5.57	
Thomasville	......	......	......	4.42	
Tuscaloosa	74	22	45.5	5.71	
Tuscumbia	71	18	44.0	4.31	
Tuskegee	76	25	49.6	5.84	T.
Union Springs	76	24	48.0	5.24	T.
Uniontown	75	20	48.4	3.99	
Valleyhead	72	15	43.4	4.17	T.
Vienna	......	......	......	4.64	
Wetumpka	77	18	51.6	4.94	
Alaska.	°	°	°	*Ins.*	*Ins.*
Chestochena	28	—55	-15.8	0.26	2.5
Copper Center	32	—74	-25.0	1.14	17.2
Fort Liscum	36	— 8	12.5	12.53	97.6
Juneau	47	—10	23.3	4.35	......
Killisnoo	45	— 7	22.2	6.90	31.0
Loring	47	—12	25.4	21.66	19.5
Orca	40	2	20.6	10.63	76.0
Sitka	48	— 2	26.2	7.25	8.3
Skagway	42	—21	14.4	......	......
Tanana	10	—69	-32.8	0.30	3.0
Teikhill	36	—45	-10.0	2.50	25.0
Arizona.					
Allaire Ranch	......	......	......	0.36	T
Alpine	......	......	......	1.44	15.0
Arizona Canal Co. Dam	79	25	53.2	0.30	
Aztec	81	26	54.2	0.00	
Benson	73	20	46.2	0.83	3.0
Bisbee	68	18	42.2	1.36	6.5
Blue	64	1	34.0	0.74	8.5
Bowie	74	18	42.6	0.62	T.
Buckeye	74	20	48.5	0.07	0.1
Casagrande	77	24	49.1	0.18	
Cline	71	21	45.0	0.94	2.0
Cochise *[1]	60	19	39.0	0.32	2.0
Congress	73	26	50.1	0.50	T.
Douglas	76	11	42.6	0.32	3.0
Dudleyville	73	21	45.8	0.57	1.0
Duncan	71[e]	11[e]	38.8[e]	0.11	0.1
Fort Apache	69	— 6	36.7	0.34	1.0
Fort Huachuca	68	20	43.1	0.30	3.0
Fort Mohave	75	18	49.6	0.80	T.
Gilabend	78	23	52.0	0.00	
Globe	67	19	43.9	0.33	
Grand Canyon	50	— 2	21.4	0.77	8.0
Greaterville	69	13	42.1	0.61	2.4
Greer	......	......	......	1.20	12.0
Holbrook	55	—11	24.6	1.12	12.0
Huachuca Res	......	......	......	4.36	15.4
Jerome	62	11	40.5	0.55	0.5
Kingman	70	14	43.8	1.28	6.0
Maricopa	79	22	49.0	0.15	
Mesa	81	23	50.7	0.12	
Mohawk Summit *[1]	74	38	54.6	0.00	
Natural Bridge	......	......	......	2.21	4.0
Nutrioso	......	......	......	1.90	17.0
Oracle	64	22	45.1	0.40	4.0
Parker	81	21	51.4	0.00	
Phoenix	78	19	48.9	0.21	T.
Picacho *[1]	75	31	50.6	......	
Pinal Ranch	......	......	......	1.55	
Pinto	......	......	......	0.03	0.3
Prescott	62	1	36.8	0.50	
Roosevelt	79	23	47.8	0.92	1.2
St. Michaels	47	—10	24.8	0.13	1.0
San Carlos	72	20	44.6	0.88	T.
San Simon	71	9	40.9	0.64	0.9
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Seligman	59	—18	34.2	1.16	9.0
Sentinel *[1]	77	32	50.9	0.00	
Show Low	......	......	......	1.58	13.0
Signal	79	18	46.6	0.61	
Taylor	62	—15	26.6	0.94	9.5
Tempe	81	18	48.6	0.13	
Thatcher	68	15	43.4	0.63	2.1
Tombstone	69	17	43.4	0.35	
Tuba	61	— 3	31.0	0.53	6.5
Tucson	83	22	50.6	0.30	2.0
Walnut Grove	......	......	......	1.50	2.0
Willcox	67	16	40.4	0.78	4.0
Yarnell	......	......	......	1.15	4.0
Young	71	3	38.6	0.90	3.0
Arkansas.					
Alicia	76	......	......	5.40	
Amity	75	15	44.2	5.24	1.3
Arkadelphia	76	18	45.6	4.13	0.9
Arkansas City	......	......	......	3.73	T.
Arnett	......	......	......	4.34	8.5
Batesville	74	14	42.3	7.49	0.2
Beebranch	71	11	41.5	5.85	4.0
Blackrock	......	......	......	6.65	1.0
Blanchard	78	17	46.0	4.01	0.5
Brinkley	76	18	43.5	5.76	
Calico Rock	......	......	......	4.95	1.1
Camden	76	20	47.0	4.94	3.0
Clarendon	......	......	......	5.70	T.
Conway	74	14	44.2	6.14	1.0
Cornerstone	75[e]	20[e]	45.4[e]	......	T.
Corning	74	13	42.4	6.91	2.3
Dallas	73	10	44.1	5.05	4.0
Dardanelle	......	......	......	5.48	2.0
Des Arc	77	18	43.8	6.34	T.
Dodd City	69	5	38.6	4.01	3.6
Dutton	67	4	38.0	5.76	4.3
Eldorado	79	19	45.2	3.88	T.
Eureka Springs	72	— 2	38.6	4.99	6.0
Fayetteville	72	5	39.0	5.13	5.7
Forrest City	77	16	43.6	6.86	T.
Fulton	......	......	......	4.00	3.0
Hardy	79	10	41.2	6.15	2.8
Heber	75	12	43.1	4.10	4.0
Helena	75	20	45.8	5.22	......
Hope	79	19	47.0	4.16	2.0
Howe	82	16	46.6	3.60	3.0
Jonesboro	82	11	44.0	7.24	......
Lacrosse	79	13	41.0	4.95	4.8
Lake Village	76	21	45.5	2.60	T.
Lewisville	77	19	47.0	5.39	1.0
Lonoke	75	16	43.0	6.79	......
Lutherville	71	10	40.6	5.16	3.0
Luxora	......	......	......	4.65	
Malvern	77	17	43.4	4.85	0.5
Marked Tree	......	......	......	5.73	0.5
Marvell	77	19	45.6	9.16	T.

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Arkansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Mossville [a]	64	7	37.5		
Mountain Home	66	10	38.9	2.61	6.0
Mount Nebo	67	10	40.6	3.61	3.5
Newport	74[c]	15[d]	42.6[e]	6.49	
Oregon	70	4	39.0	3.65	3.5
Ozark	74	9	42.0	5.28	2.5
Perry	71	19	44.4	6.05	1.0
Pinebluff	76	19	44.0	8.02	1.5
Pocahontas	75	10[e]	41.5	6.55	0.3
Pond	71			2.91	11.5
Prescott	77[h]	18[f]	47.3[g]		1.0
Princeton	77	16	45.4	6.90	
Rison	75	16	45.0		
Russellville	73	3	38.4		
Silversprings	72	2	39.4	2.21	6.9
Spielerville	74	12	43.0	4.92	2.5
Stuttgart	77	16	45.2	6.76	T.
Tate	74	11	44.4	5.20	2.0
Texarkana	74	16	44.1	2.98	
Warren				9.60	
White Cliffs				1.16	
Wiggs	74	11	43.0	4.93	1.0
Winchester	75	21	46.4	4.70	
Witts Springs	60	8	36.4		
California.					
Alturas	54	−7	29.5	3.87	
Angiola	72	27	46.4	1.40	
Auburn	72	27	51.8	13.44	
Azusa	79	26	52.4	4.90	
Bagdad	73	31	51.0	T.	
Bakersfield	78	26	52.8	0.60	
Barstow	74	22	50.0	0.65	
Bear Valley				25.23	24.0
Berkeley	64	33	48.2	6.92	
Bishop	70	15	40.6	2.34	
Blocksburg	69	21	43.9	20.87	2.0
Blue Canyon	65	17	40.4	24.73	14.0
Bodie	53	−13	23.4	5.80	62.0
Bowman				23.44	47.0
Branscomb	76	23	46.2	28.77	T.
Brush Creek	68	14	41.7	27.54	
Butte Valley				16.05	54.0
Calexico	75	32	52.9	0.00	
Campbell	69	29	48.6	3.92	
Campo				2.98	2.0
Cedarville	49	3	29.6	4.10	33.0
Chico	68	32	49.0	6.80	
Claremont	80	29	52.4	3.94	
Cloverdale	74	30	49.2	15.86	
Colfax	70	26	51.4	21.62	
Colusa	69	30	47.7	5.10	
Craftonville				3.06	
Crescent City	64	30	46.8	8.59	
Crockers				22.52	
Cuyamaca	51	13	35.9	5.44	
Delta	73	25	48.2	17.73	T.
Dobbins	75	29	51.7	16.00	
Donner				13.12	58.0
Drytown				9.15	T.
Durham	72	28	48.0	6.46	
Elcajon	79	25	52.5	1.20	
Electra	70	32	51.4	10.80	
Elmwood	69	22	48.7	2.27	
Elsinore	78	20	49.0	1.25	
Emigrant Gap	50	20	38.0	18.80	47.0
Escondido	78	20	49.6	2.78	
Folsom	72	29	49.1	8.80	
Fordyce				28.28	119.0
Fort Bragg				10.12	
Fort Ross	62	32	47.8	14.78	
Fruitvale				5.39	
Georgetown	69	22	46.1	22.11	
Gilroy (near)	73	20	50.8	7.33	
Glendora				5.01	
Grass Valley				23.54	
Greenville	62	6	35.1	19.13	24.0
Hanford	95	24	51.4	1.59	
Healdsburg	77	29	49.5	15.81	
Heber	82	25	54.2	T.	
Hollister	72	26	49.5	4.88	
Indio	83	23	53.8	T.	
Idylwild	63	9	41.1	3.34	
Iowa Hill	72	23	47.0	19.98	
Irvine				2.61	
Isabella				4.10	
Jamestown	70	25	47.6	11.41	
Jolon				3.50	
Kennedy Gold Mine				9.26	
Kentfield				16.39	
Kernville				4.02	
King City	90	24	52.2	1.27	
Laporte	62	13	37.8	29.87	76.1
Laytonville				26.24	
Le Grand	78	26	48.0	1.69	
Lemoncove	68	27	49.2	5.18	
Lick Observatory	59	23	43.3	11.66	
Livermore	71	28	49.6	5.56	
Lodi	64	28	46.8	5.96	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lone Pine	72	17	42.4	1.00	
Los Gatos	71	35	49.7	13.65	
Lowe Observatory				4.55	
Magalia	74	10	47.6	36.01	
Mammoth	77	27	52.6	0.00	
Marysville	70	27	48.6	7.14	
Merced	72	22	48.6	2.11	
Mercury				19.43	
Mills College				5.92	
Milo				11.22	
Milton (near)	63	31	49.2	6.76	
Mohave	68	20	46.9	1.00	
Mokelumne Hill	68	30	48.2	10.49	
Mono Ranch	66	16	43.1	2.96	
Montague	59	−2	32.0	5.97	7.0
Monterio	62	20	41.9	3.85	
Monumental	63	24	38.2	19.16	22.5
Mount St. Helena				24.88	
Napa	74	28	45.9	6.36	
Needles	75	31	54.4	0.10	
Nellie				7.62	T.
Nevada City	79	14	45.0	20.13	
Newcastle	69	28	48.2	11.94	
Newman	66	26	48.2	1.88	
Niles	68	32	49.6	5.27	
Nimshew	71	22	45.5	26.45	
North Bloomfield				20.54	
Oakland	65	36	50.0	4.59	
Orland	72	30	48.8	4.45	
Orleans	74	30	45.9	13.91	
Oroville (near)	74	30	48.4	8.61	
Ozena				1.13	
Palermo	74	27	48.0	6.32	
Peachland	70	27	48.2	14.96	
Pilot Creek				27.76	9.0
Pine Crest	76	36	55.1	5.61	
Placerville	66	20	44.7	14.36	
Point Lobos	68	45	55.9	3.34	
Porterville	71	26	50.2	2.54	
Poway	75	23	51.6	2.25	
Priest Valley				3.98	
Quincy	49	3	31.7	15.85	16.1
Redding	73	29	48.8	9.97	
Redlands	77	28	52.4	1.48	
Reedley	69	25	49.1	3.54	
Represa				9.01	
Riovista	65	25	47.4	5.16	
Riverside	82	26	51.7	1.38	
Rocklin	70	29	48.4	10.80	
Rohnerville	68	28	47.8	9.48	
Sacramento	63	28	47.8	8.14	
Salinas	74	30	52.0	2.50	
Salton	70	25	48.5	0.00	
San Bernardino	80	25	51.6	2.97	
San Jacinto	77	23	49.4	1.42	
San Leandro	70	27	48.0	5.51	
San Miguel Island				3.10	
Santa Barbara	76	36	54.8	4.26	
Santa Clara College	74	29	50.4	3.90	
Santa Cruz	77	29	50.5	4.93	
Santa Maria	78	30	53.0	2.64	
Santa Monica	78	38	54.0	3.95	
Santa Rosa	70	28	48.2	10.95	
Sausalito				6.37	
Shasta	79	27	49.0	14.16	
Sierra Madre	76	36	53.6	5.05	
Sisson	58	17	35.8	10.10	15.0
Skyland				29.54	
Snedden				2.10	
Sonoma	70	30	47.8	8.18	
Sterling	62	27	42.6	33.58	6.0
Stockton	60	28	46.2	4.69	
Storey	69	24	45.8	2.16	
Summerdale	65	12	39.6	26.41	26.0
Summit	43	12	31.1	14.10	138.0
Susanville	48	4	30.8	7.48	37.0
Tamarack	64	0	34.0	16.85	168.5
Tejon	69	30	49.7	1.73	
Towle	65	15	39.7	15.56	
Truckee	48	−6	27.2	12.11	102.0
Tulare	74	24	50.2	2.14	
Tustin				2.49	
Ukiah	71	24	47.7	17.20	
Upland	70	30	47.2	3.88	
Upperlake	74	28	47.6	11.35	
Upper Mattole				16.08	
Vacaville	73	26	49.3	10.58	
Ventura	78	34	56.8	2.36	
Visalia	76	21	48.4	2.87	
Volcano	80	24	42.6	0.00	
Wasco	71	21	47.6	0.78	
Wasioja				3.48	
Weldon				2.41	
Westpoint				12.93	
West Saticoy				2.19	
Wheatland	66	27	47.1	7.68	
Willits	82	21	47.7	24.05	
Willows	70	35	52.9	4.80	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Woodleaf				30.85	2.0
Woodside	65	31	48.6	11.59	
Yreka				10.48	16.0
Zenia	69	18	44.2	21.27	2.0
Colorado.					
Akron				0.25	3.0
Alford	62	−7	30.6	0.02	0.8
Antelope Springs	50	−31	9.0	1.72	19.1
Ashcroft	46	−20	18.0	1.81	29.0
Bennett				0.20	3.0
Blaine	64	−4	33.8	0.33	5.0
Boulder	70	8	39.0	0.22	3.2
Breckenridge	49	−25	19.0	1.18	19.0
Buenavista	54	−3	26.0	0.76	6.0
Burlington	69	3	34.1	0.48	5.6
Canon City	68	3	40.6	0.54	5.2
Cardinal	51	−10	22.8	1.98	22.0
Castlerock	67	−16	30.2	0.13	2.0
Cheesman	64	−10	30.5	0.09	1.5
Cheyenne Wells	66	0	33.8	0.21	3.0
Clearview	53	−14	25.5	0.30	5.5
Collbran	50	−13	21.6	0.77	7.0
Colorado Springs	62	−1	32.8	0.47	5.4
Cripplecreek				0.69	7.8
Delta				0.30	0.3
Eagle	45	−23	17.1	0.86	11.5
Fort Collins	68	−4	30.9	0.01	T.
Fort Morgan	65	−4	30.8	T.	
Fowler				0.22	3.5
Frances	54	−3	24.6	0.62	
Fruita	47	−6	22.2	1.05	6.0
Garnett	53	−14	19.7	0.07	1.2
Gleneyre	66	−5	32.3	0.31	3.8
Glenwood Springs [g]	53	−14	20.1		
Grand Valley	57	−11	25.0	1.16	6.8
Greeley	69	−2	32.2	T.	T.
Grover				0.00	
Gunnison	39	−45	1.0	1.55	27.0
Hahns Peak	37	−26	13.6	2.23	35.0
Hamps	65	−5	30.9	0.38	4.0
Hoehne	67	−11	31.5	0.29	2.0
Holly	74	7	37.3	0.32	3.5
Idaho Springs	60	−2	32.2	0.25	3.0
Lake City	49	−20	17.0	1.23	11.5
Lake Moraine	46	−19	21.8	0.86	13.0
Lamar	78	7	39.6	0.40	4.0
Laporte				T.	T.
Las Animas	68	4	34.7	0.00	
Lay	42	−29	15.2	1.29	18.0
Leroy	64	1	32.8	0.23	2.4
Longs Peak	53	−12	23.9	0.33	4.0
Mancos	53	−13	26.6	1.79	26.5
Meeker	47	−20	18.1	0.81	12.3
Moraine	55	−5	27.2	0.55	7.0
Pagoda	48	−16	22.0	1.23	22.0
Paonia	50	−8	24.8	1.91	12.8
Platte Canon				0.65	6.8
Rockyford	67	3	34.7	0.23	2.5
Saguache	50	−8	21.9	0.13	2.0
Salida	59	−14	28.6	0.47	3.5
San Louis	56	−18	23.9	0.05	0.6
Santa Clara	61	−10	30.5	0.52	11.0
Sapinero	45	−27	11.7	1.54	19.2
Sheridan Lake	69	1	33.2	0.10	1.1
Silt	50	−7	25.0	1.05	8.5
Silverton	48	−20	17.8	3.00	58.5
Stonewall				0.18	3.0
Sugar City				0.22	4.0
Trinidad	67	−4	35.8	0.46	7.0
Victor	55	−8	28.2	0.40	1.7
Vilas				0.27	4.0
Wagon Wheel	52	−32	11.2	0.71	11.0
Waterdale	67	−7	35.2	0.13	2.0
Westcliffe	57	−14	26.8	0.30	3.0
Whitepine	40	−27	14.4	2.53	38.5
Wray	69	0	33.0	0.55	5.5
Yuma				0.38	6.0
Connecticut.					
Bridgeport	56	5	34.8	3.61	2.9
Canton	68	−1	31.0	2.14	1.0
Colchester	60	−1	33.1	4.14	5.0
Falls Village				2.05	4.6
Hawleyville	58	3	32.6	3.00	5.0
Lake Konomoc				4.74	
New London	58	5	34.8	2.88	9.5
North Grosvenor Dale	66	0	31.2	2.91	
Norwalk	56	−3	32.3	2.96	3.5
Southington	58	−4	33.0	2.30	4.8
South Manchester				2.32	6.0
Storrs	68	0	31.9	3.16	
Voluntown	62	−5	33.7	3.48	7.5
Wallingford				4.15	6.5
Waterbury	61	2	33.2	2.79	4.0
West Cornwall	66	0	30.2	2.41	7.3
West Simsbury				2.21	6.0
Delaware.					
Delaware City				2.86	1.5
Milford	75	8	41.4	3.35	3.0

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Delaware—Cont'd.					
Millsboro	76	5	41.6	3.23	2.0
Newark	70	8	37.4	3.44	0.8
Seaford	73	7	40.7	2.53	2.0
District of Columbia.					
West Washington	72	10	39.8	3.45	2.2
Florida.					
Apalachicola	75	32	53.8	5.18	
Archer	85	30	57.8	4.63	
Avon Park	84	38	62.0	4.54	
Bartow	84	36	60.8	5.40	
Bonifay	78	28	52.2	11.63	
Brooksville	87	35	58.8	7.04	
Carrabelle	75	30	53.8	5.71	
Caxambus	86	37	67.8	3.25	
Clermont	87	37	61.7	5.57	
De Funiak	77	24	50.6	5.90	
Deland	85	35	60.9	......	
Eustis	84	33	59.0	5.57	
Federal Point	85	37	58.0	3.53	
Fernandino	79	38	56.5	4.54	
Flamingo	83	44	69.0	6.40	
Fort Meade	86	34	60.6	4.13	
Fort Myers	83	41	62.8	2.02	
Fort Pierce	80	39	64.3	3.07	
Gainesville	84	33	56.6	3.00	
Grasmere	81	36	58.0	......	
Huntington	85	33	56.9	3.75	
Hypoluxo	84	45	66.0	3.98	
Inverness	85	32	57.7	3.74	
Jasper	80	32	54.0	4.45	
Kissimmee	78	38	58.6	6.43	
Lake City	81	32	55.7	3.54	
Macclenny	84	30	56.2	4.42	
Malabar	85	38	61.9	2.32	
Manatee	84	38	61.4	4.79	
Marianna	75	29	50.8	6.90	
Merritt Island	79	42	62.6	3.13	
Miami	83	46	67.4	3.20	
Middleburg	85	24	54.9	3.77	
Molino	78	21	50.4	4.19	
Monticello	79	30	54.0	4.74	
New Smyrna	.....	.....	.....	6.37	
Nocatee	87	39	63.2	3.58	
Ocala	85	33	58.4	4.16	
Orange City	88	32	58.7	4.59	
Orange Home	84	33	59.1	5.63	
Orlando	83	35	59.6	5.03	
Plant City	85	34	61.1	4.72	
Rockwell	81[f]	25[f]	56.2[f]	2.90	
St. Andrews	76	29	51.8	6.82	
St. Augustine	82	38	57.1	2.91	
St. Leo	85	35	60.0	6.10	
Stephensville	85[g]	30[g]	53.5[g]	2.51	
Sumner	82	29	56.0	4.34	
Switzerland	83	35	56.6	3.01	
Tallahassee	78	31	53.0	7.55	
Tarpon Springs	84	36	59.4	4.78	
Titusville	83	36	59.8	2.56	
Wausau	80	28	52.6	9.62	
Georgia.					
Abbeville	.....	.....	.....	4.36	
Adairsville	66	21	44.4	6.67	4.5
Albany	79	23	50.3	5.13	
Allapaha	77	29	51.2	4.28	
Americus	72	26	48.4	7.82	1.0
Athens	69	21	42.3	8.93	3.2
Bainbridge	80	24	50.9	5.78	
Blakely	78	26	52.1	9.10	
Bowersville	67	22	42.5	11.14	.....
Butler	.....	.....	.....	5.64	1.3
Camak	72	19	43.2	6.40	T.
Canton	.....	.....	.....	10.80	0.3
Carlton	.....	.....	.....	7.44	0.1
Carrollton	67	20	42.9	4.67	.....
Clayton	66	19	43.2	10.98	4.0
Columbus	74[f]	22[f]	47.2[f]	5.86	0.1
Cordele	79	26	49.6	3.73	
Covington	.....	.....	.....	7.46	
Cuthbert	75	27	50.2	7.50	1.0
Dahlonega	64	18	43.2	9.75	2.0
Dawson	78	26	51.4	7.91	T.
Diamond	68	16	45.0	8.86	4.6
Dublin	.....	.....	.....	3.63	T.
Eastman	76	33	50.8	4.38	T.
Eatonton	71	21	47.5	6.57	
Elberton	66	24	44.9	8.24	1.0
Experiment	68	21	46.0	4.99	2.5
Fitzgerald	76	28	51.5	3.69	
Fleming	82	26	54.1	4.55	
Forsyth	70	21[e]	47.6[h]	6.70	5.8
Fort Gaines	76	26	48.0	6.65	
Gainesville	66	.....	43.4[e]	6.94	5.5
Gillsville	67	20	44.6	7.69	3.5
Glenville	77	30	50.9	5.25	
Greenbush	67	18	43.4	6.92	2.0
Greensboro	71	19	45.6	6.11	0.8
Griffin	68	21	47.6	5.72	2.0
Harrison	77	21	48.0	3.45	0.5
Georgia—Cont'd.					
Lost Mountain	68	20	44.4	6.82	6.6
Louisville	80	25	51.0	3.67	T.
Lumpkin	76	24	49.0	5.72	0.5
Marshallville	71	25	50.3	8.59	1.5
Mauzy	80	30	53.0	4.25	T.
Milledgeville	73	20	47.5	5.33	T.
Millen	79	21	49.4	3.96	
Montezuma	.....	.....	.....	6.69	
Monticello	70	23	46.5	9.23	.....
Morgan	77	29	49.6	8.61	T.
Newnan	69	19	44.2	7.60	0.9
Oakdale	.....	.....	.....	8.45	1.7
Oxford	67[i]	22[i]	44.6[i]	6.58	3.5
Point Peter	69	17	44.4	8.45	2.0
Poulan	78	27	50.6	2.45	
Putnam	76	25	48.6	7.04	
Quitman	76	31	51.9	4.81	
Ramsey	67	16	45.0	6.14	1.0
Resaca	.....	.....	.....	5.44	2.5
Rome	68	19	43.4	5.03	4.0
St. George	83	33	55.6	8.48	
St. Marys	81	31	54.8	5.50	T.
Screven	79	30	56.8	4.08	
Talbotton	73	23	47.8	5.95	3.0
Tallapoosa	66	19	43.3	4.89	2.5
Toccoa	65	20	42.8	10.09	12.0
Valdosta	79	32	53.0	3.05	
Valona	78	32	52.9	4.25	
Vidalia	76	26	53.4	4.87	
Washington	72	28	45.0	6.03	0.2
Waycross	80	32	53.2	3.74	
Waynesboro	79	23	49.4	2.87	T.
Westpoint	71	22	46.0	4.74	0.2
Woodbury	70	18	45.8	5.72	1.2
Idaho.					
American Falls	44	− 3	23.6	2.20	.....
Blackfoot	41	−10	21.3	0.92	9.0
Caldwell	47	2	28.5	2.30	14.3
Cambridge	43	−10	22.6	4.07	40.7
Chesterfield	39	−30	15.6	3.82	21.0
Dent	.....	.....	.....	3.24	15.9
Ellerslie	50	1	28.8	1.63	6.8
Fernwood	.....	.....	.....	3.54	27.0
Forney	50	−16	21.8	2.18	21.8
Franklin	.....	.....	.....	3.04	17.0
Glens Ferry	48	− 2	28.2	.....	.....
Grangeville	50	13	33.2	1.82	16.2
Hope	.....	.....	.....	5.52	49.0
Hot Springs	52	8	32.0	0.97	4.5
Idaho Falls	42	−15	20.3	1.07	8.0
Kellogg	49	4	30.6	2.84	21.8
Ketchum	.....	.....	.....	5.20	52.0
Lake	32	−10	13.4	2.10	21.0
Lakeview	48	10	31.3	3.35	27.0
Landore	48	− 1	24.9	6.51	60.4
Lardo	.....	.....	.....	6.10	.....
Lost River	39	−16	14.9	2.30	19.2
Meadows	42	− 9	22.8	3.70	38.0
Milner	47	− 6	25.6	1.34	13.0
Mink Creek	.....	.....	.....	2.71	25.1
Minidoka	44	2	24.7	1.26	.....
Moscow	46	11	33.6	1.96	12.0
Murray	43	− 5	25.6	4.03	47.0
Newport	41	2	28.8	4.31	33.0
Oakley	55	1	27.6	1.20	12.0
Paris	40	−17	19.6	2.67	20.5
Pearl	.....	.....	.....	2.83	.....
Porthill	44	8	29.0	2.63	41.0
St. Maries	48	8	32.6	2.44	23.0
Salem	.....	.....	.....	0.93	4.3
Salmon	40	−11	18.4	1.20	7.2
Soldier	45	−24	13.0	4.89	70.0
Stanrod	.....	.....	.....	1.30	13.5
Twin Falls	47	3	26.4	1.01	7.0
Vernon	46	−14	17.8	0.95	9.5
Westlake	.....	.....	.....	1.58	15.8
Weston	42	−17	18.7	2.24	15.5
Illinois.					
Albion	72	3	37.2	5.44	2.5
Aledo	63	− 2	28.0	2.57	11.0
Alexander	70	4	32.5	1.72	3.0
Antioch	58	3	28.2	3.20	1.0
Ashton	61	2	27.2	2.40	9.5
Astoria	61	5	30.5	2.16	5.7
Aurora	61	4	29.2	3.10	0.9
Benton	71	7	39.4	4.85	2.0
Bloomington	66	5	32.1	2.66	3.5
Bushnell	65	3	30.2	2.44	4.6
Cambridge	63	1	29.8	3.11	16.0
Carlinville	72	7	34.1	3.12	3.5
Carlyle	.....	.....	.....	3.08	.....
Carrollton	73	7	34.6	3.15	4.0
Charleston	69	0	35.7	3.31	1.3
Chester	.....	.....	.....	5.85	3.7
Cisne	73	4	38.2	3.99	T.
Coatsburg	66	1	30.2	3.00	7.0
Cobden	73	5	39.2	6.45	2.0
Colchester	67	3	31.2	2.68	5.0
Illinois—Cont'd.					
Decatur	69	6	33.2	3.04	1.5
Dixon	61	0	26.6	2.07	.....
Dwight	64	5	31.2	2.99	3.0
Equality	75	7	40.0	7.60	2.0
Flora	68	5	35.6	.....	2.1
Friendgrove	72	5	37.8	6.19	3.0
Galva	64	0	27.8	3.01	11.0
Grafton	.....	.....	.....	1.86	2.5
Greenville	72	5	35.4	4.50	5.5
Griggsville	70	9[i]	35.2	2.74	.....
Halfway	72	4	38.6	6.18	4.0
Havana	68	3	32.6	1.69	.....
Henry	65	1	30.6	2.23	8.0
Hillsboro	71	4	35.8	3.56	3.3
Hoopeston	66	5	33.5	2.52	2.6
Joliet	63	6	31.0	2.23	3.7
Kishwaukee	60	0	26.8	2.60	9.5
Knoxville	64	− 1	29.0	3.30	4.1
Lagrange	62	6	30.1	1.61	1.8
Laharpe	68	0	29.2	3.35	10.0
Lanark	59	− 6	25.6	2.60	13.3
Loami	.....	.....	.....	2.94	2.5
McLeansboro	73	5	37.6	6.20	2.0
Martinsville	71	0	33.5[d]	3.85	4.0
Martinton	68	5	32.4	3.26	1.0
Mascoutah	72	5	35.0	4.28	5.0
Mattoon	69	8	38.0	2.71	2.0
Minonk	63	5	30.6	1.89	3.5
Monmouth	63	− 1	28.4	3.29	9.7
Morrison	58	0	27.2	2.34	13.7
Morrisonville	69	5	33.6	3.44	2.6
Mount Carmel	.....	.....	.....	5.85	3.1
Mount Vernon	72	3	39.0	3.74	1.0
New Burnside	73	9	38.6	6.65	3.5
Olney	72	3	37.2	3.37	4.7
Ottawa	60	6	30.8	2.07	1.2
Palestine	70	− 1	36.6	4.81	5.0
Pana	70	3	33.2	2.78	1.0
Paris	69	7	34.7	4.99	.....
Philo	67	5	32.8	2.55	1.0
Plumhill	74	10	37.4	4.05	2.5
Pontiac	65	6	32.4	3.07	4.0
Rantoul	66	6	33.0	3.47	0.5
Raum	74	3	38.6	6.81	3.5
Riley	59	1	27.4	2.73	9.0
Robinson	70	0	35.9	4.47	5.0
Rockford	60	0	29.8	3.29	19.0
Rushville	67	6	32.7	1.75	3.5
St. Charles	60	0	28.8	2.27	6.8
St. John	73	6	37.6	4.30	.....
Shobonier	72	3	36.2	4.50	2.0
Streator	.....	.....	.....	2.26	
Sullivan	69	4	34.2	3.07	1.9
Sycamore	59	1	27.3	2.99	8.5
Tilden	74	6	38.2	4.51	1.6
Tiskilwa	67	2	28.4	2.39	8.0
Tuscola	68	4	33.8	2.96	0.7
Urbana	67	2	32.3	1.65	1.0
Walnut	63	3	29.3	2.92	9.5
Warsaw	.....	.....	.....	2.58	9.0
Winchester	70	8	33.4	2.92	1.7
Windsor	70	1	34.2	2.88	1.5
Winnebago	60	0	26.8	3.72	11.0
Yorkville	61	4	28.8	1.94	6.0
Zion	59	− 4	24.8	3.52	8.0
Indiana.					
Anderson	69	− 1	35.2	1.74	4.8
Angola	62	9	32.9	2.64	6.2
Auburn	66	9	32.3	1.89	.....
Bedford	74	5	38.2[e]	2.92	5.0
Bloomington	70	4	38.0	4.61	6.0
Bluffton	70	0	33.4	1.72	2.0
Butlerville	73	− 7	37.2	4.25	9.3
Cambridge City	71	11	33.8	2.59	4.0
Columbus	73	−10	36.4	2.59	7.5
Connersville	73	− 9	35.6	2.62	4.0
Crawfordsville	68	6	33.2	3.40	.....
Delphi	70	4	32.2	3.66	1.3
Elkhart	67	16	33.7	3.29	4.8
Farmersburg	72	0	36.9	4.14	3.5
Fort Wayne	68	9	35.0	2.01	1.0
Franklin	72	− 6	36.2	1.35	3.5
Greencastle	69	2	35.2	3.96	2.0
Greenfield	70	8	36.4	2.05	0.5
Greensburg	70	0	37.2	2.73	8.2
Hammond	67	6	33.0	2.37	3.0
Holland	74	2	39.8	4.27	.....
Huntington	63	8	31.0	2.12	2.0
Jeffersonville	71	8	39.2	2.81	3.0
Knox	66	5	33.1	3.57	0.8
Kokomo	68	4	34.4	2.80	1.0
Lafayette	68	5	33.2	3.70	1.2
Laporte	63	8	31.5	2.66	1.7
Lima	64	10	31.8	2.32	2.0
Logansport	68	8	32.5	2.54	2.6
Madison	73	4	39.8	3.37	5.5
Marengo	72	− 3	37.2	3.35	4.0
Marion	68	4	34.3	2.69	2.4

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Indiana—Cont'd.					
Markle	68	5	34.1	3.30	......
Mauzy	71	−11	34.4	2.54	5.0
Moores Hill	72	− 5	35.9	3.46	7.5
Mount Vernon	69	6	37.0	6.75	2.0
Northfield	67	− 1	32.6	3.50	2.0
Paoli	74	5	38.4	3.32	......
Plymouth	65	7	31.0	2.57	......
Princeton	72	2	37.9	7.10	5.5
Rensselaer	67	6	34.0	2.35	1.0
Richmond	72	−11	34.8	2.29	3.0
Rochester	66	8	33.6	3.56	0.5
Rockville	68	3	34.6	3.35	T.
Rome	72	5	41.5	2.95	4.0
Salem	70	2	37.4	2.49	6.0
Scottsburg	72	0	38.4	3.24	6.0
Seymour	72	− 5	38.1	1.75	......
Shelbyville	70	− 6	35.6	2.02	1.7
South Bend	66	6	31.2	2.42	2.5
Syracuse	65	7	35.7	3.47	1.0
Terre Haute	71	8	35.8	4.61	2.0
Valparaiso	67	3	32.8	3.54	3.0
Veedersburg	69[a]	1[d]	34.0[a]	2.63	......
Vevay	73	4	38.4	3.10	4.0
Vincennes	73	4	36.2	3.62	2.0
Washington	71	5	35.4	3.76	3.0
Winamac	71	6	36.3	2.71	1.0
Indian Territory.					
Ardmore	78	7	42.8	0.85	5.0
Calvin	......	......	......	1.96	10.5
Durant	75	− 5	40.1	1.43	7.0
Fairland	71	− 4	38.4	2.65	13.5
Fort Gibson	......	......	......	2.70	15.5
Hartshorne	......	4	......	2.03	10.5
Healdton	76	5	42.2	1.34	7.0
Marlow	78	12	42.2	0.87	4.5
Muskogee	72	0	38.9	1.43	6.0
Ravia	74	7	42.8	1.10	3.3
Stillwell	75	6	34.4	3.45	10.0
Tulsa	73	− 4	38.4	2.34	10.4
Vinita	70	−12	37.6	1.79	10.0
Wagoner	73	− 2	38.8	2.43	14.0
Webbers Falls	78	−10	40.2	2.50	10.0
Iowa.					
Afton	52	− 7	27.8	0.40	4.0
Albia	60	− 9	27.0	2.12	11.5
Algona	49	−11	22.8	1.11	10.2
Allerton	54	− 7	27.7	1.61	14.1
Alta	53	−11	23.0	0.72	7.0
Alton	52	− 9	25.0	0.38	3.8
Amana	49	− 9	24.6	2.91	12.1
Ames	49	−10	24.8	1.12	9.0
Atlantic	55	− 5	28.2	0.80	8.0
Audubon	55	−10	27.8	0.71	7.0
Baxter	54	− 4[f]	25.6[e]	1.33	15.0
Bedford	57	− 5	27.4	1.24	6.5
Belleplaine	42	−15	22.0	3.46	28.6
Bonaparte	66	− 4	28.0	1.74	8.0
Boone	51	−10	24.3	1.73	12.1
Britt	47	−17	21.6	1.14	7.3
Buckingham	......	......	......	3.11	25.3
Burlington	65	− 1	30.2	3.23	14.0
Carroll	56	−11	25.0	0.87	8.5
Cedar Rapids	53	− 8	23.7	2.08	11.5
Chariton	60	−10	27.1	2.00	22.0
Clarinda	58	− 4	28.7	0.82	8.2
Clearlake	44	− 5	21.8	0.90	8.5
Clinton	59	0	27.4	3.25	12.5
College Springs	53	− 2	29.8	0.45	4.5
Columbus Junction	64	− 5	27.6	2.45	8.8
Corning	51	− 6	27.4	1.33	11.9
Corydon	62	− 8	27.5	1.39	12.5
Creston	50	− 7	27.8	1.26	12.6
Cumberland	......	......	......	1.40	14.0
Decorah	43	−12	21.2	2.88	17.0
Delaware	45	−10	21.5	1.72	2.9
Denison	58	− 8	27.5	0.50	5.0
Desoto	52[c]	−10	28.0[b]	1.74	17.7
Dows	46	−15	21.8	1.85	14.0
Earlham	51	−11	26.4	2.00	20.0
Elkader	49	−12	22.3	2.40	17.5
Elliott	57	− 5	30.4	0.70	7.0
Estherville	53	−10	22.1	1.15	7.0
Fayette	46	−16	20.8	3.44	18.0
Forest City	48	−14	21.0	0.90	9.0
Fort Dodge	50	−11	22.6	0.92	9.2
Fort Madison	......	......	......	2.79	13.1
Galva	54	−10	25.6	0.47	4.7
Gilman	......	......	......	0.88	3.0
Glenwood	56	− 4	30.4	0.55	5.5
Grand Meadow	44	−15	21.6	2.13	14.5
Greenfield	50	−10	27.6	1.57	14.4
Grinnell	52	−12	24.4	1.95	21.5
Grundy Center	45	−15	22.8	2.25	19.0
Guthrie Center	52	−10	27.5	1.20	11.2
Hampton	50	−13	23.2	1.14	14.5
Hancock	57	− 4	28.8	0.75	5.0
Hanlontown	51	−15	21.0	0.71	7.1
Harlan	57	− 7	27.4	0.45	5.5

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Iowa—Cont'd.					
Hopeville	59	− 7	28.0	1.01	......
Humboldt	50	−10	24.9	0.43	8.0
Ida Grove	55	− 9	26.6	0.75	7.5
Independence	42	−14	21.0	3.30	18.0
Indianola	63	− 9	27.7	1.46	12.0
Inwood	56	−15	23.4	0.28	3.6
Iowa City	58	− 9	23.9	2.51	10.6
Iowa Falls	43	−15	22.2	2.02	17.2
Jefferson	54	−11	25.8	1.13	10.6
Keosauqua	66	− 5	27.2	2.37	16.8
Knoxville	56	− 8	27.2	2.75	22.5
Lacona	......	......	......	1.81	17.0
Larrabee	53	−12	24.2	0.56	6.4
Leclaire	......	......	......	2.15	10.5
Lemars	55	−10	24.6	0.40	4.0
Lenox	52	−10	27.5	0.81	8.1
Leon	60	− 6	28.1	1.60	15.4
Little Sioux	61	−10	28.6	0.79	6.0
Logan	57	− 1	27.8	0.85	8.5
Maple Valley	......	......	......	0.60	6.0
Maquoketa	56	− 5	24.2	2.96	8.0
Marshalltown	50	−12	23.2	2.21	18.8
Mason City	49	−12	23.2	1.15	11.5
Monticello	45	− 7	23.6	......	......
Mountayr	61	− 6	29.0	1.65	17.0
Mount Pleasant	65	− 6	28.0	2.06	7.5
Mount Vernon	55	−11	23.8	2.68	9.7
Muscatine	......	......	......	2.53	10.6
New Hampton	46	−17	20.4	1.61	......
Northwood	46	−13	20.7	1.32	13.0
Odebolt	54	−10	26.8	0.60	6.0
Olin	51	− 5	25.3	3.45	8.2
Onawa	61	− 6	28.8	0.93	9.3
Osage	45	−14	20.8	2.00	18.0
Oskaloosa	55	−11	25.6	1.24	11.8
Ottumwa	64	− 5	28.7	1.27	......
Pacific Junction	56	− 3	28.5	0.62	6.1
Pella	55	−10	26.6	2.57	20.5
Plover	49	−12	24.0	0.61	5.0
Pocahontas	54	−13	24.6	0.61	6.2
Redoak	56	0	31.8	1.03	12.0
Ridgeway	50	− 9	23.2	4.71	22.7
Rock Rapids	54	−12	22.4	0.75	7.5
Rockwell City	51	−11	26.5	1.20	12.0
Sac City	53	−10	25.6	0.77	7.8
St. Charles	64	− 8	29.0	1.40	8.7
Sheldon	55	−15	24.6	1.12	8.0
Sibley	54	−14	21.2	0.52	5.2
Sidney	53	− 6	28.0	0.60	6.0
Sigourney	55	−10	26.8	4.21	25.5
Sioux Center	53	−10	23.4	0.65	6.5
Stockport	65	− 5	28.2	1.79	16.5
Storm Lake	50	−12	22.8	0.80	8.0
Stuart	49	− 2	27.5	1.30	13.0
Thurman	54	− 3	29.2	0.70	7.1
Tipton	60	− 2	26.5	2.76	10.2
Toledo	48	−13	24.0	2.33	29.0
Vinton	49	−14	23.2	1.77	17.7
Wapello	61[f]	0[f]	28.9[f]	2.04	7.0
Washington	62	− 9	26.8	2.51	18.5
Washta	54	−13	25.6	0.64	6.2
Waterloo	46	−13	22.3	2.94	18.9
Waukee	48	−10	26.2	2.40	24.0
Waverly	42	−12	22.2	1.80	16.0
Webster City	47	−16	24.6	1.50	15.0
Westbend	51	−13	23.7	0.85	8.3
Whitten	42	−17	22.0	1.90	19.0
Wilton Junction	59	− 5	26.4	3.12	15.5
Winterset	47	−10	26.4	1.60	12.0
Woodburn	57	− 8	27.0	1.73	16.0
Zearing	44	−12	23.4	1.28	10.2
Kansas.					
Abilene	......	......	......	0.42	3.0
Alton	68	2	33.4	0.70	4.0
Anthony	......		......	0.50	2.5
Atchison	69	3	33.0	0.52	4.5
Baker	65	0	29.8	0.85	8.5
Beloit	......	......	......	0.30	0.5
Blue Rapids	......	......	......	0.50	3.8
Burlington	70	6	36.6	0.75	0.8
Chapman	......	......	......	......	2.0
Clay Center	65	2	33.2	0.61	2.2
Coffeyville	70	0	35.8	......	......
Colby	70	0	34.5	0.50	5.0
Columbus	70	− 6	35.4	2.72	11.5
Coolidge	73	......	....	0.43	6.0
Cottonwood Falls	70	5	33.7	0.50	4.9
Cunningham	72	7	37.0	0.34	1.4
Dresden	71	2	35.0	0.57	3.0
Eldorado	69	5	36.5	1.25	0.5
Ellinwood	70	5	35.8	0.49	2.5
Ellsworth	69	4	34.2	0.46	2.8
Emporia	71	6	35.1	0.82	5.5
Englewood	77	10	38.6	0.34	2.0
Enterprise	68	4	34.0	0.43	2.5
Eureka	......	......	......	0.92	2.0
Fall River	70	6	37.6	1.58	4.0
Farnsworth	73	2	36.4	0.15	3.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Kansas—Cont'd.					
Forsha	71	6	36.2	0.25	2.0
Fort Scott	71	1	36.6	2.80	10.0
Frankfort	62	1	32.6	0.80	8.0
Garden City	70	3	35.6	0.30	3.1
Gove*[1]	72	4	35.4	0.30	3.0
Grenola	67	......	......	0.94	1.0
Harrison	66	0	32.0	0.35	3.0
Hays	70	4	34.0	0.15	3.5
Horton	66	0	32.0	0.57	5.0
Hoxie	66	0	34.6	0.40	4.0
Hugoton	76	4[g]	38.4[d]	T.	T.
Hutchinson	70	7	35.8	0.74	3.2
Independence	69	7	37.8	1.55	6.7
Jetmore	70	5	37.9	0.20	2.0
Jewell	......	......	......	0.26	5.0
La Crosse	73	5	36.0	0.16	3.0
Lakin	73	2	35.2	0.50	6.0
Larned	73	2	35.3	0.19	4.0
Lebo	69	5	34.1	0.64	1.0
Lindsborg	......	......	......	0.32	2.2
Macksville	73	5	35.7	0.45	4.5
McPherson	66	7	34.8	0.64	0.5
Madison	70	3	35.0	0.64	......
Manhattan *b*	67	3	34.0	0.89	3.5
Manhattan *c*	67	4	33.2	0.40	3.7
Marion	......	......	......	0.20	2.0
Medicine Lodge	72	9	36.6	0.52	0.5
Minneapolis	65	5	33.4	0.37	2.5
Moran	68	0	35.9	1.43	5.0
Mounthope	......	......	......	0.65	T.
Neosho Rapids	......	......	......	0.52	0.5
Ness City	......	......	......	0.40	3.5
Norton	69	− 5	33.1	0.45	4.0
Norwich	......	......	......	0.65	3.0
Oberlin	......	......	......	0.60	5.0
Osage City	71[e]	4[e]	35.2[e]	0.22	0.9
Oswego	68	− 4	36.8	2.30	11.0
Ottawa	66	2	33.4	1.69	3.5
Pittsburg	70	− 6	35.4	2.82	15.0
Plainville	68	2	32.0	0.56	4.5
Pleasanton	72	7	35.4	1.60	6.0
Pratt	70	7	36.2	0.40	3.0
Republic	65	− 2	31.7	0.59	3.0
Rome	72	8	38.0	0.92	1.0
Russell	69	3	35.1	0.34	2.2
Salina	69	6	34.4	0.53	3.0
Sedan	69	9	36.5	0.93	T.
Toronto	70	5	32.8	0.84	3.0
Ulysses	75	4	37.7	0.30	3.0
Valley Falls	70	6	34.4	0.57	3.6
Wakeeney	70	0	35.6	0.22	2.5
Wakeeney (near)	......	......	......	0.25	2.5
Wallace	71	2	33.9	0.18	4.0
Walnut	68	1	36.2	2.83	12.0
Wamego*[1]	68	3	33.5	0.60	3.8
Winfield	69	6	36.4	0.89	0.5
Kentucky.					
Alpha	70	3	43.7	5.13	4.8
Anchorage	74	0	36.8	2.58	5.0
Bardstown	73	− 1	39.6	4.30	2.0
Beattyville	76	− 2	37.8	2.29	4.0
Beaver Dam	74	4	39.1	2.73	2.2
Berea	73	− 4	40.8	3.20	3.0
Blandville	73	8	39.7	7.84	1.8
Bowling Green	72	11	41.5	3.39	1.0
Burnside	73	5	40.6	3.28	6.0
Cadiz	75	8	41.4	3.93	2.5
Calhoun	74	8	42.6	3.31	2.0
Catlettsburg	78	6	40.6	3.32	4.0
Earlington	74	6	38.2	3.50	3.0
Edmonton	76	3	41.2	4.66	2.0
Eubank	73	1	37.6	3.28	2.5
Falmouth	......	......	......	3.43	3.5
Farmers	78	− 9	39.0	2.69	3.0
Frankfort	75	− 1	39.4	3.08	1.7
Franklin	78	14	41.8	2.35	1.0
Greensburg	75	2	38.2	4.58	0.8
High Bridge	76	1	40.2	2.71	3.0
Hopkinsville	74	8	40.5	3.40	1.0
Irvington	73	7	40.6	1.43	3.0
Jackson	76	6	42.8	3.30	3.0
Leitchfield	71	2	39.6	2.62	5.0
Loretto	80	0	42.0	3.96	......
Manchester	73	4	41.4	3.33	4.5
Marion	71	17	40.2	6.37	......
Maysville	80	− 2	37.0	3.02	4.2
Middlesboro	72	15	42.1	4.36	2.5
Mount Sterling	73	− 1	38.8	3.28	5.5
Owensboro	71	10	39.5	3.59	1.5
Owenton	72	8	38.6	4.46	7.0
Paducah	75	13	40.0	4.50	T.
Princeton	74	5[e]	41.9	3.75	T.
Richmond	75	− 1	39.6	3.10	......
St. John	71	− 1	36.6	2.24	4.5
Scott	80	− 1	37.6	3.47	4.3
Shelby City	73	− 5	39.1	3.86	5.0
Shelbyville	76	− 6	37.4	3.54	3.5
Taylorsville	74	− 5	38.5	4.01	2.0

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Kentucky—Cont'd.	°	°	°	*Ins.*	*Ins.*
West Liberty	77	− 8	40.0	2.38	0.4
Williamsburg	73	14	41.2	2.80	3.0
Williamstown	73	1	38.4	3.02	3.0
Louisiana.					
Abbeville	84	23	51.9	3.35	
Alexandria	79	21	50.4	3.76	
Amite	80	25	50.8	4.26	
Baton Rouge	81	27	52.1	4.21	
Burnside	78[f]	27[f]	52.6[f]	3.24	
Calhoun	77	20	48.1	3.69	T.
Cameron	70	24	51.4	2.49	
Clinton	81	25	50.8	6.19	
Collinston	77	22	47.3	3.70	T.
Covington	77	27	49.2	2.89	
Donaldsonville	82	27	54.2	4.15	
Farmerville	......	......	......	3.33	T.
Franklin	80	27	53.2	2.60	
Georgetown	79	20	50.0	4.34	T.
Grand Coteau	78	23	52.5	3.15	
Hammond	78	27	50.9	3.99	
Houma	79	27	52.1	1.98	
Jennings	78	24	51.8	2.36	
Lafayette	77	25	51.9	3.52	
Lake Charles	77	24	50.7	2.50	
Lakeside	78	26	51.6	1.90	
Lawrence	79	30	53.3	2.43	
Logansport	......	......	......	2.27	T.
Melville	76	23	49.6	4.15	
Minden	85	20	47.4	0.80	
Monroe	......	......	......	3.98	
Morgan City	......	......	......	1.08	
New Iberia	77	27	53.3	3.07	
Opelousas	78	24	50.6	2.55	
Plain Dealing	77	19	46.4	5.22	1.5
Rayne	77	24	53.3	2.49	
Reserve	78	28	51.8	2.64	
Robeline	77	14	46.4	3.51	T.
Saint Francisville	78	25	51.3	6.00	
Schriever	83	28	51.2	1.97	
Simmesport	......	......	......	3.01	
Southern University	......	......	......	1.35	
Sugar Experiment Station	78	29	53.0	1.66	
Sugartown	75	23	50.0	3.97	
Maine.					
Bar Harbor	63	2	29.1	4.46	6.0
Cornish	58	− 4	25.8	2.93	9.0
Danforth	......	......	......	3.95	5.6
Debsconeag	50	−10	19.8	2.71	17.5
Fairfield	52	− 7	25.0	2.59	7.5
Farmington	50	− 7	22.7	2.29	6.0
Ft. Fairfield	50	−24	14.0	1.86	5.0
Gardiner	55	− 3	28.2	2.95	......
Greenville	48	−10	19.4	1.20	......
Houlton	52	−12	20.5	2.70	......
Lewiston	56	− 1	25.8	3.15	8.2
Madison	50	− 6	21.2	4.04	8.5
Mayfield	46	− 6	22.2	2.69	7.5
Millinocket	47	−13	20.1	3.09	14.2
North Bridgton	60	− 7	24.8	2.77	8.0
Oquossoc	56	−15	18.8	2.03	13.0
Orono	52	− 6	26.7	3.11	6.2
Patten	47	−15	18.8	......	......
Rumford Falls	49	− 4	23.4	2.01	6.8
The Forks	......	......	......	2.24	8.5
Thomaston	52	− 1	28.0	3.84	1.0
Vanburen	47	−25	13.6	1.40	14.0
Winslow	53	− 7	24.2	2.78	6.5
Maryland.					
Annapolis	64	17	40.0	3.24	1.5
Bachmans Valley	68	7	36.9	2.92	3.5
Boettcherville	75	9	37.6	2.43	4.0
Cambridge	72	19	41.8	2.41	3.0
Cheltenham	72	9	39.4	2.93	1.5
Chestertown	70	13	39.2	2.29	1.5
Chewsville	70	2	36.6	1.65	2.0
Clearspring	68	9	36.4	2.73	2.5
Coleman	72	14	39.8	3.60	2.0
Collegepark	71	6	39.3	3.21	1.0
Cumberland	......	......	......	2.88	1.5
Darlington	66	11	37.8	3.39	1.7
Deerpark	70	− 3	32.4	......	6.0
Easton	71	12	40.2	2.10	1.2
Fallston	61	12	37.4	3.51	2.5
Frederick	69	10	39.5	2.19	1.5
Frostburg	......	......	......	2.91	4.7
Grantsville	70	6	33.4	4.09	7.0
Greenspring Furnace	75	6	36.8	2.61	2.7
Harney	......	......	......	2.69	2.5
Jewell	75	12	40.4	2.62	2.0
Johns Hopkins Hospital	......	......	......	2.85	1.5
Keedysville	73	5	38.6	2.26	1.8
Lake Montebello	63	12	39.4	3.43	1.5
Laurel	71	8	39.2	3.59	2.0
McDonogh	66	8	37.6	4.74	1.5
Mount St. Marys College	67	12	37.8	2.73	1.0
New Market	68	11	37.8	3.19	1.5
Oakland	72	− 6	35.2	......	......
Pocomoke City	72	17	43.1	3.22	1.0

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Maryland—Cont'd.	°	°	°	*Ins.*	*Ins.*
Porto Bello	67	12	40.4	1.08	0.8
Prince Frederickton	75	14	40.4	2.59	3.0
Princess Anne	73	11	41.8	2.75	2.2
Solomons	65	17	40.4	1.62	1.5
Sudlersville	74	10	40.0	2.66	1.0
Takoma Park	70	12	38.2	3.56	3.2
Van Bibber	65	14	38.2	3.21	1.0
Westernport	70	12	36.8	2.53	4.5
Woodstock	70	6	39.0	3.38	2.1
Massachusetts.					
Amherst	60	4	30.2	2.18	5.0
Bedford	65	4	32.1	2.32	1.5
Bluehill (summit)	65	2	32.1	3.27	7.8
Cambridge	67	5	33.4	2.82	......
Chestnuthill	68	5	34.1	3.65	5.5
Concord	66	3	31.9	2.42	5.3
East Templeton *[1]	59	1	29.0	2.01	4.0
Fallriver	60	7	35.4	3.67	9.0
Fitchburg	63	3	31.6	2.50	6.5
Framingham	67	1	31.6	2.50	3.7
Groton	62	2	29.6	2.68	10.5
Hyannis	......	......	......	4.80	10.5
Jefferson	......	......	......	2.86	7.3
Lawrence	66	4	31.9	2.57	7.0
Leominster	......	......	......	2.39	5.0
Lowell	64	4	32.8	2.43	......
Ludlow Center	55	− 3	26.8	2.68	4.0
Middleboro	67	− 7	33.5	4.68	11.8
Monson	62	1	32.2	2.91	9.5
New Bedford	60	8	35.5	3.66	8.0
Pittsfield	......	......	......	2.08	7.0
Plymouth	67	2	34.4	4.05	11.5
Princeton	......	......	......	2.61	4.0
Provincetown	52	13	35.0	3.77	6.5
Salem	......	......	......	2.74	6.0
Somerset *[1]	64	0	33.7	3.10	11.5
Sterling	......	......	......	2.33	1.8
Taunton	62	− 4	32.3	2.81	5.0
Webster	......	......	......	2.79	7.7
Westboro	65	4	33.8	3.12	5.8
Weston	66	3	32.2	2.22	5.1
Williamstown	63	− 2	29.6	1.36	4.7
Winchendon	......	......	......	1.92	6.5
Worcester	65	5	32.4	2.05	5.9
Michigan.					
Adrian	66	7	32.4	1.80	2.0
Agricultural College	62	10	31.8	1.99	2.4
Alma	56	8	30.4	3.52	9.0
Ann Arbor	62	11	32.2	1.91	3.6
Arbela	60	9	31.8	3.38	7.8
Baldwin	49	−10	25.2	2.10	13.0
Ball Mountain	58	8	30.4	2.30	6.5
Baraga	......	......	......	1.70	17.0
Battlecreek	68	12	32.2	2.70	3.0
Bay City	56	10	29.2	2.68	9.5
Benzonia	53	13	28.5	4.37	20.5
Berlin	58	9	30.2	2.38	6.3
Big Rapids	55	8	28.6	5.77	19.0
Birmingham	60	9	31.7	2.02	7.6
Bloomingdale	63	11	32.3	3.54	1.5
Calumet	47	− 1	23.2	1.78	22.0
Cassopolis	67	8	31.9	5.00	6.0
Charlevoix	48	9	29.0	2.47	13.0
Charlotte	62	7	32.4	2.23	10.8
Chatham	42	− 7	20.8	2.65	26.5
Cheboygan	52	− 1	25.8	1.70	8.0
Clinton	66	8	32.8	1.92	2.5
Coldwater	70	9	35.2	2.83	9.0
Concord	62	9	30.4	2.13	3.8
Dundee	67	10	34.0	1.64	1.5
Eagle Harbor	48	5	25.8	1.58	......
East Tawas	48	11	28.0	2.39	3.7
Eloise	65	9	32.7	1.82	3.2
Flint	59	11	31.4	2.65	8.5
Frankfort	42	......	......	......	......
Gaylord	......	......	......	1.80	18.0
Grand Marais	36	11	23.6	2.60	26.0
Grape	67	10	33.4	0.89	0.7
Grasslake	61	9	30.7	3.04	7.0
Grayling	52	4	26.3	2.72	17.2
Hagar	63	11	31.9	4.58	2.5
Harbor Beach	52	9	30.0	2.53	4.0
Harrison	52	7	27.2	3.80	14.0
Harrisville	48	10	28.5	4.05	20.5
Hastings	62	10	31.6	2.86	5.2
Hayes	58	12	30.2	3.31	10.5
Highland	......	......	......	1.33	5.2
Holland	64	12	30.8	3.12	5.5
Howell	59	8	30.3	1.44	3.5
Humboldt	42	−21	18.4	3.30	33.0
Iron Mountain	46	− 4	22.0	1.54	16.0
Iron River	46	−15	18.8	2.40	16.0
Ironwood	44	− 7	19.6	2.80	28.0
Ishpeming	43	−11	18.6	5.30	53.0
Ivan	54	6	26.2	2.53	17.5
Jackson	63	12	32.4	1.91	5.0
Jeddo	58	10	31.0	2.49	6.4
Kalamazoo	67	10	31.0	3.03	12.0

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lake City	......	......	......	2.40	14.0
Lansing	63	12	32.0	2.38	6.7
Ludington	47[j]	14	31.2[e]	3.20	14.0
Mackinac Island	47	0	27.6	1.08	10.8
Mackinaw City	52	4[f]	25.1[e]	......	7.0
Mancelona	46	10	25.6	1.74	16.0
Maple Ridge	41	− 4	21.2	3.90	30.0
Marine City	52	17	32.0	......	......
Menominee	44	− 1	25.5	1.20	12.0
Mio	48	4	26.3	3.00	12.1
Montague	57	12	31.0	3.25	5.5
Mount Clemens	61	10	30.8	1.66	4.7
Muskegon	......	......	......	2.47	4.0
Newberry	......	......	......	1.63	16.3
Old Mission	51	10	28.0	6.32	12.2
Olivet	62	9	31.0	2.66	7.1
Omer	53	9	28.6	4.63	10.0
Petoskey	50	5	29.0	1.80	10.5
Plymouth	62	5	32.0	2.10	2.5
Pontiac	64	9	32.0	1.27	2.5
Port Austin	58	13	30.1	2.80	4.5
Reed City	53	0	27.4	4.75	25.7
Saginaw (W. S.)	60	10	31.6	3.26	7.3
St. James	49	11	27.3	7.30	41.0
St. Johns	63	11	32.2	2.85	4.8
St. Joseph	64	16	33.4	3.51	2.0
Slocum	59	3	29.4	2.52	......
Somerset	63	9	31.4	......	4.0
South Haven	64	11	31.2	2.54	T.
Staunton	55[e]	9[e]	28.8[e]	2.28	5.8
Thomaston	46	−13	19.1	2.80	28.0
Thornville	61	13	32.4	3.23	17.5
Traverse City	50[e]	14[e]	29.6[e]	2.57	16.0
Vassar	60	10	31.8	3.95	6.5
Wasepi	64	9	32.0	2.46	5.5
Webberville	60	8	31.2	4.03	4.5
Wetmore	40	− 9	21.1	2.20	22.0
Whitefish Point	42	6	24.3	2.65	19.4
Woodlawn	46	1	23.6	2.95	12.5
Ypsilanti	63	6	31.1	2.09	6.0
Minnesota.					
Albert Lea	47	−15	20.7	1.77	13.0
Alexandria	49	−26	14.2	1.16	15.2
Amboy	49	−15	21.6	1.70	10.0
Angus	39	−28	9.6	0.07	......
Ashby	50	−25	14.0	1.27	14.8
Bagley	44	−37	13.4	0.40	4.0
Beardsley	51	−19	18.2	0.48	4.8
Beaulieu	38	−25	10.8	0.50	8.5
Bemidji	51	−32	14.2	0.70	12.8
Bird Island	44	−16	18.2	0.63	6.3
Brainerd[a]	......	−20	14.6	......	......
Caledonia	42	−16	19.9	1.55	13.5
Collegeville	45	−15	18.5	0.87	9.1
Crookston	35	−26	9.4	1.20	12.0
Detroit	40	−39	9.4	1.20	18.0
Faribault	44	−16	19.8	0.73	14.0
Farmington	43	−14	19.8	1.75	17.5
Fergus Falls	41	−24	16.0	1.27	12.7
Glencoe	43	−12	19.4	0.20	2.0
Grand Meadow	44	−16	19.0	1.94	13.2
Hallock	38	−30	7.0	0.60	6.0
Hinckley	49	−21	16.8	......	......
Hovland	58[e]	−25[e]	24.4[e]	1.26	12.9
Lake Winnibigoshish	47	−28	12.6	0.96	11.8
Leech	47	−26	12.1	1.66	18.2
Little Falls	44	−18	16.1	1.50	15.0
Long Prairie	49	−25	15.0	1.22	12.8
Luverne	48	−12	22.7	0.20	3.1
Lynd	53	−11	21.2	0.43	4.5
Mankato	......	......	......	0.75	10.7
Mapleplain	43	−14	18.5	1.58	15.4
Milaca	46	−18	16.0	......	......
Milan	49	−17	18.2	1.10	11.0
Montevideo	46	−16	14.4	0.81	7.5
Mora	51	−21	16.0	1.68	17.8
Morris	42	−22	15.8	0.73	9.0
Mount Iron	46	−21	14.8	0.32	3.2
New London	49	−21	15.6	1.32	13.0
New Richland	50	......	......	1.05	10.5
New Ulm	48	−10	19.5	1.42	14.2
Park Rapids	42	−31	11.0	1.36	13.6
Peterson	......	......	......	1.32	9.4
Pine River	43	−27	15.4	1.44	19.4
Pipestone	45	−12	20.0	0.15	1.5
Pokegama Falls	48	−26	14.2	1.30	13.9
Redwing	43	−11	21.2	1.86	......
Reeds	......	......	......	0.76	......
Rolling Green	49	− 9	22.1	0.70	7.0
St. Charles	42	−15	19.6	1.97	......
St. Cloud	47	−15	17.8	1.20	7.0
St. Peter	48	−18	21.4	0.93	9.3
Sandy Lake Dam	47	−24	14.0	1.65	25.8
Shakopee	42	−15	19.6	1.55	13.0
Stillwater	......	......	......	1.51	10.9
Tonka	......	......	......	0.99	......
Two Harbors	46	−16	19.5	1.46	17.0
Wabasha	......	......	......	1.83	18.2

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Minnesota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Wadena	46	—30	11.6	0.84	14.0
Willow River	47	—27	14.6	1.66	18.6
Winnebago	52	—14	27.6	1.87	12.0
Winona	44	— 9	19.9	1.23	13.0
Worthington	50	—10	21.2	0.56	4.0
Zumbrota	41	—14	19.5	1.94	19.4
Mississippi.					
Aberdeen	74	20	43.3	3.20	
Austin	77	18	44.8	6.34	
Batesville	74	19	44.4	4.45	
Bay St. Louis	74	27	50.9	4.50	
Biloxi	72	27	52.0	2.88	
Booneville	71	14	44.6	3.69	
Brookhaven	80[d]	22[h]	48.8[f]	5.58	
Canton	80	20	48.2	3.78	
Columbia	.....	.....	.....	5.63	
Columbus	74	21	45.2	3.21	
Corinth	71	15	42.4	4.04	T.
Crystal Springs	78	21	48.0	2.79	
Duck Hill	78	18	46.8	2.82	
Edwards	78	22	49.9	3.32	T.
Enterprise	.....	.....	.....	4.24	
Fayette	70	23	48.8	2.60	
Fayette (near)	.....	.....	.....	3.90	
Greenville *b*	79	21	47.3	3.49	T.
Greenwood	78	20	46.8	3.07	
Hattiesburg	78	25	49.0	5.15	
Hazlehurst	79	22	48.2	3.00	
Hernando	74	15	43.4	3.60	T.
Holly Springs	73	16	42.2	5.15	
Indianola	74	20	46.0	4.15	T.
Jackson	79	22	47.4	3.68	
Kosciusko	77	19	47.0	4.23	T.
Lake	76	20	45.6	5.04	
Lake Como	76	27	48.0	5.09	
Laurel	.....	.....	.....	3.00	
Leakesville	76	24	49.9	4.69	
Louisville	76	21	47.1	2.91	T.
McNeill	77	25	50.8	3.46	
Macon	.....	.....	.....	2.74	
Magee	75	20	46.4	6.16	
Magnolia	80	22	50.2	7.30	T.
Merrill	.....	.....	.....	3.25	
Natchez	79	24	53.1	4.02	
Nitta Yuma	.....	.....	.....	3.95	
Patmos	.....	.....	.....	3.44	
Pearlington	76	27	50.8	4.26	
Pecan	74	27	51.2	2.77	
Pittsboro	76	17	45.6	3.06	
Pontotoc	79	18	44.8	2.26	T.
Port Gibson	80	23	47.0	3.91	
Porterville	75	19	46.7	3.97	
Quitman	76	22	48.4	4.36	
Ripley	71	16	44.6	6.10	T.
Shelby	76	20	47.1	3.93	0.2
Shoccoe	79	21	48.6	3.36	T.
Shubuta	.....	.....	.....	3.20	
Stonington	.....	.....	.....	3.91	T.
Suffolk	77	22	49.8	3.07	T.
Swan Lake	75	21	45.5	4.35	T.
Tchula	80	24	48.2	2.90	T.
Tupelo	75	20	44.3	4.35	
University	74	16	45.2	4.31	2.0
Utica	75	22	46.0	4.70	
Walnutgrove	76	21	47.0[d]	2.63	
Watervalley	74	17	45.4	3.56	T.
Waynesboro	78	23	49.6	4.95	
Woodville	76	23	50.5	4.05	
Yazoo City	79	22	48.4	4.36	
Missouri.					
Albany	.....	.....	.....	1.05	7.6
Appleton City	71	— 5	34.2	3.76	19.0
Arthur	72	— 5	36.6	2.41	8.0
Avalon	69	— 3	31.2	2.88	12.0
Belle	66	1	35.9	2.16	3.0
Bethany	67	— 5	29.0	1.55	8.5
Birchtree	71	2	38.8	4.96	2.5
Bolivar	70	1	36.2	2.92	14.0
Boonville	.....	.....	.....	3.13	7.4
Brunswick	71	— 7	31.4	2.77	9.5
Cape Girardeau	.....	.....	.....	6.28	8.9
Caruthersville	76	14	42.2	7.06	T.
Conception	66	— 2	30.5	0.60	6.0
Darksville	70	— 4	33.4	3.32	6.0
Dean	72	— 8	38.1	3.21	.....
Decaturville	69	2	37.2	3.50	12.0
De Soto	73	1	38.2	4.28	3.5
Doniphan	73	7	40.2	6.15	8.3
Downing	.....	.....	.....	1.85	7.0
Eldorado Springs	71	— 3	36.3	3.38	15.0
Fairport	.....	.....	.....	1.00	6.3
Fayette	68	1	33.0	3.42	12.0
Fulton	71	4	34.9	2.92	8.0
Gallatin *[1]	70	2	32.8	1.05	5.0
Gano	72	0	37.7	3.36	7.8
Glasgow	.....	.....	.....	2.45	6.0
Goodland	71	0	36.6	4.16	5.8
Gorin	.....	.....	.....	1.25	2.5

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Grant City	64	— 4	30.4	1.18	10.0
Harrisonville	69	4	32.0	2.61	11.0
Hermann	.....	.....	.....	2.15	0.3
Houston	70	2	37.2	3.61	4.1
Ironton	73	2	36.8	4.32	1.8
Jackson	77	1	39.8	7.66	5.5
Jefferson City	71	6	33.8	2.57	6.2
Joplin	71	0	36.2	3.40	19.5
Kidder	67	0	30.6	1.46	7.6
Koshkonong	72	8	39.5	6.28	2.7
Lamar	70	— 6	37.4	3.11	13.0
Lamonte	.....	.....	.....	1.85	5.0
Lebanon	70	3	35.6	3.25	6.0
Lexington	70	4	34.1	1.95	9.0
Liberty	69	2	33.6	1.54	7.9
Lockwood	70	— 5	33.8	2.53	7.5
Louisiana	72	6	33.5	3.09	5.7
Macon	70	0	33.2	2.69	.....
Marblehill	75	— 2	39.2	6.43	2.0
Marshall	69	— 4	32.0	2.70	5.9
Maryville	62	— 1	29.0	0.88	8.0
Mexico	69	4	32.2	3.43	7.6
Monroe	69	2	31.3	2.40	4.8
Mountain Grove	68	5	36.2	3.53	3.5
Mount Vernon	73	4	35.4	4.28	12.0
Neosho	.....	.....	.....	3.03	15.0
New Haven	73	8	37.2	3.55	5.5
New Madrid	.....	.....	.....	7.57	.....
New Palestine	76	5	36.6	3.13	9.2
Oakfield	73	4	37.3	3.22	4.8
Olden	73	— 1	38.2	4.79	2.3
Oregon	65	0	32.4	0.95	7.5
Osceola	.....	.....	.....	3.81	7.5
Pine Hill	.....	.....	.....	7.88	7.0
Princeton	70	— 4	31.2	1.65	15.0
Protem	71	5	39.4	4.32	5.8
Rockport	.....	.....	.....	1.12	8.0
Rolla	.....	.....	.....	3.11	6.5
St. Charles	73	6	36.4	4.27	4.0
St. Joseph	.....	.....	.....	0.81	4.0
Sarcoxie	.....	.....	.....	3.09	11.5
Sedalia	70	0	34.8	3.50	11.5
Seymour	69	4	36.4	3.34	9.0
Sikeston	76	8	40.6	7.50	4.0
Steffenville	68	2	32.3	3.57	6.5
Sublett	66	— 5	30.0	3.45	9.0
Trenton	66	— 1	30.6	1.95	13.5
Unionville	62	— 8	27.2	3.29	16.0
Versailles	80	4	36.6	4.40	14.5
Warrensburg	70	5	36.7	1.70	.....
Warrenton	72	6	34.0	2.65	5.4
Warsaw	71	— 1	35.9	3.40	12.9
Wheatland	.....	.....	.....	3.55	12.5
Willowsprings	68	— 1	34.9	4.63	5.0
Windsor	65	3	34.4	2.72	11.6
Zeitonia	76	1	38.2	4.17	1.5
Montana.					
Absarokee	.....	.....	.....	0.35	3.5
Adell	53	—14	29.0	0.85	8.5
Anaconda	55	— 3	31.0	0.89	.....
Augusta	60	—26	28.2	0.51	5.0
Billings	65	—12	31.3	0.71	5.2
Boulder	52	— 9	26.5	0.25	3.4
Bozeman	50	— 4	25.0	0.74	10.7
Butte	49	— 4	25.4	1.10	11.0
Canyon Ferry	47	—11	24.0	1.20	12.0
Cascade	.....	—28	.....	0.20	7.1
Chester	46	—29	13.8	0.35	3.5
Chinook	55	—21	18.4	0.04	.....
Choteau	61	—21	28.5	0.12	.....
Clear Creek	57	0	30.2	.....	.....
Columbia Falls	.....	— 4	25.3	2.32	20.5
Cooke	.....	.....	.....	4.03	40.3
Copper	.....	.....	.....	1.11	16.3
Crow Agency	55	—16	24.4	0.65	6.5
Culbertson	44	—26	12.2	0.71	6.0
Dayton	53	7	29.8	0.85	7.8
Decker	56	—15	21.9	.....	.....
Deerlodge	.....	.....	.....	0.38	3.8
Dillon	52	— 2	27.1	1.01	9.6
Ekalaka	55	—18	25.4	0.33	3.3
Fallon	50	—26	19.4	0.07	0.7
Forsyth	56	—16	24.9	0.20	2.0
Fort Benton	62	—16	27.1	.....	.....
Fort Harrison	55	— 5	25.1	.....	.....
Fort Logan	65	—25	22.6	1.45	14.5
Glasgow	45	—30	12.6	0.20	2.0
Gold Butte	.....	.....	.....	0.51	4.0
Graham	57[h]	—23[h]	25.8[h]	1.13	5.2
Grayling	36	—33	12.9	1.37	29.0
Greatfalls	53	—24	29.2	0.32	.....
Hamilton	57	7	31.5	0.99	21.0
Highwood	.....	.....	.....	0.61	7.0
Homepark	.....	.....	.....	1.00	6.8
Lakeview	.....	.....	.....	1.00	18.0
Lewistown	60	—19	29.6	0.50	8.0
Livingston	58	— 2	31.8	0.79	11.4
Lodge Grass	48	—14	23.2	0.55	14.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Montana.	°	°	°	*Ins.*	*Ins.*
Malta	45	—31	15.8	0.17	1.7
Marion	49	— 3	26.1	.....	.....
Marysville	50	4	25.8	2.10	.....
Millets Ranch	.....	.....	.....	0.63	6.2
Missoula	48	4	26.6	0.85	10.0
Nye	.....	.....	.....	0.58	14.0
Ovando	49	—12	22.0	1.37	13.2
Parrot	55	— 9	28.6	0.40	.....
Philipsburg	55	— 4	28.7	0.27	8.7
Plains	48	4	28.7	0.60	6.0
Poplar	49	—24	13.0	0.40	4.0
Raymond	.....	.....	.....	0.30	4.5
Redlodge	53	— 9	26.6	0.31	10.0
Ridgelawn	44	—24	13.8	0.75	7.5
St. Pauls	58	—20	30.4	0.99	11.6
St. Peter	52	—18	30.2	0.32	7.0
Saltese	.....	.....	.....	5.46	54.0
Springbrook	48	—25	20.4	0.89	8.7
Steele	65	—21	31.4	0.40	6.5
Tokna	51	—23	17.0	0.64	6.3
Twin Bridges	55	—14	24.2	0.20	2.0
Utica	56	—21	30.8	0.55	12.5
Virginia City	50	— 5	24.8	1.20	12.4
Warrick	.....	.....	.....	0.42	4.2
Whitlash	.....	.....	.....	0.18	.....
Wibaux	45	—16	16.7	0.81	5.8
Wolf Creek	54	—13	30.0	0.38	11.4
Wolsey	48	—26	20.8	1.00	23.2
Yale	55	—31	27.2	0.60	6.0
Nebraska					
Agate	60	—19	26.6	0.47	5.2
Agee *[1]	.....	—17	23.3	0.67	6.8
Ainsworth	65	—13	28.8	0.65	8.9
Albion	62	—14	26.8	0.80	8.0
Alma	67	— 3	31.8	0.17	1.8
Arapaho	.....	.....	.....	0.75	6.0
Arcadia	.....	.....	.....	0.60	6.0
Ashland	60	— 3	30.8	0.48	7.1
Ashton	.....	.....	.....	0.08	7.0
Auburn	59	— 1	31.4	0.70	7.0
Aurora	65	— 3	32.5	0.20	2.0
Beatrice	59	— 1	30.8	0.62	6.0
Beaver	67	1	34.1	0.33	3.5
Bellevue	57[h]	— 4	31.1[d]	0.78	7.9
Benkleman	.....	.....	.....	0.60	6.0
Blair	60	— 6	29.0	0.52	6.3
Bloomfield	64	—18	27.1	0.03	1.5
Bluehill	.....	.....	.....	0.20	2.0
Bradshaw	.....	.....	.....	0.46	4.6
Bridgeport	65	— 9	30.8	T.	T.
Broken Bow	65	—11	30.6	0.55	5.5
Burchard	.....	.....	.....	0.52	8.2
Burge	.....	.....	.....	1.06	10.6
Burwell	.....	.....	.....	0.50	5.0
Callaway	66	—13	31.2	0.50	6.5
Central City	.....	.....	.....	0.95	9.0
Chester	.....	.....	.....	0.60	5.0
Clearwater	65	—19	27.0	0.34	4.2
Cody	.....	.....	.....	0.35	3.5
Columbus	65	— 4	27.6	0.19	3.0
Crawford	.....	.....	.....	0.40	6.0
Crete	62	— 3	31.1	0.37	3.2
Culbertson	63	0	33.2	0.32	6.0
Curtis	65	— 8	29.4	0.45	4.5
David City	60	— 6	29.4	0.72	7.2
Dawson	60	— 1	32.1	0.71	5.5
Duff	.....	.....	.....	0.45	4.5
Dunning	.....	.....	.....	0.50	5.0
Edgar	.....	.....	.....	0.60	6.0
Ellis	.....	.....	.....	0.60	6.0
Ericson	.....	.....	.....	1.00	10.0
Ewing	.....	.....	.....	0.00	.....
Fairbury	65	— 3	30.1	0.42	6.0
Fairmont	62	— 6	28.1	1.00	6.5
Fort Robinson	63	—10	27.6	0.37	3.8
Franklin	67	.....	.....	0.38	3.8
Fremont	60	— 5	29.0	0.73	8.0
Fullerton	.....	.....	.....	0.70	7.0
Geneva	66	— 4	31.0	0.19	1.1
Genoa (near)	63	— 8	29.3	0.49	6.0
Gering	.....	.....	.....	T.	T.
Gordon	.....	.....	.....	0.47	4.7
Gosper	.....	.....	.....	0.29	4.0
Gothenburg	68	— 9	32.0	0.37	3.7
Grand Island	65	— 2	31.9	0.50	5.0
Grant	68	— 3	33.3	0.15	2.5
Greeley	.....	.....	.....	0.30	3.0
Guide Rock	.....	.....	.....	0.55	4.0
Haigler	.....	.....	.....	0.23	5.0
Halsey	63	—14	30.2	0.40	4.0
Hartington	58	—15	26.2	0.65	6.5
Harvard	63	— 4	29.8	0.34	3.3
Hastings *[1]	64	— 4	31.0	0.48	5.0
Hayes Center	68	— 2	33.8	0.60	7.0
Hay Springs	62	—14	27.5	0.35	3.5
Hebron	63	0	31.0	0.64	4.5
Hendley	.....	.....	.....	0.40	4.0
Hickman	.....	.....	.....	0.20	2.0

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	Ins.	Ins.
Holbrook				0.31	2.2
Holdrege	66	−3	32.8	0.30	3.5
Hooper *1	56	−5	26.6	0.57	8.2
Imperial	65	0	32.6	0.65	8.0
Johnstown				0.60	6.0
Kearney	66	2	32.8	0.72	4.9
Kennedy	62	−14	29.4	1.30	13.0
Kimball	61	0	30.0	0.15	1.5
Kirkwood	63	−20	27.0	1.05	10.5
Leavitt	62	−5	29.4	0.44	
Level				0.35	3.5
Lexington	68	−7	31.0	0.50	5.0
Loup	65	−9	29.2	0.25	3.0
Lynch	65	−24	27.6	0.60	6.0
McCook				0.25	2.5
McCool				0.52	3.2
Madison	60	−10	28.2	0.75	8.0
Marquette				0.41	4.1
Merriman				0.15	1.5
Minden	65	−2	31.2	0.40	3.8
Monroe				0.63	7.1
Nebraska City	58	−1	31.8	0.35	3.5
Nemaha				0.35	3.5
Norfolk	63	−16	27.3	0.54	7.5
North Loup	67	−10	29.8	0.67	6.8
Oakdale	62	−13	25.9	0.47	5.5
Oakland	61	2	28.0	0.50	4.0
Odell				0.24	2.5
Ord				0.32	3.2
Osceola				0.20	
Palmer				0.30	3.0
Palmyra *1	62	−2	30.4	0.20	3.0
Pawnee City	60	0	31.0	0.85	8.0
Plattsmouth				0.52	5.2
Plymouth	61	3	33.5	0.01	
Purdum	63	−18	28.8	0.65	6.5
Ravenna	66	−7	30.6	0.51	5.3
Red Cloud	65	8	31.0	0.85	8.5
Republican				0.55	5.5
Rulo				0.75	7.5
St. Libory				0.55	5.5
St. Paul	65	−4	30.6	0.46	4.6
Santee	64	−12	28.0	0.60	6.0
Schuyler				0.60	6.0
Seward	62	−5	28.8	0.60	6.0
Smithfield				0.45	4.5
Springview	60	−14	28.0	0.40	4.0
Stanton	62	−16	29.4	0.62	6.2
Strang				0.20	2.5
Stratton				0.30	3.0
Stromsburg				0.30	3.0
Superior	62	−4	30.4	0.40	3.0
Syracuse				0.55	5.5
Tablerock				0.70	7.0
Tecumseh	59	−1	31.0	0.28	6.5
Tekamah	62	−6	28.2	0.80	7.5
Turlington	60	−2	30.1	0.87	8.2
University Farm	61	−4	31.2	0.29	5.5
Wahoo				0.60	6.0
Wakefield	62	−13	26.7	0.52	5.2
Wallace				0.60	6.0
Wauneta				0.50	5.0
Weeping Water				0.54	8.0
Westpoint				0.30	3.0
Whitman				0.20	2.0
Wilber				0.52	6.0
Wilsonville				0.30	3.0
Winnebago	63	−18	26.4	0.45	6.2
Wisner				0.59	6.5
Wymore				0.40	4.0
York	63	−4	30.5	0.67	5.5
Nevada.					
Amos	47	−7	24.0	3.16	
Austin	48	8	29.5	0.31	
Battle Mountain	56	0	29.8	0.90	9.0
Beowawe *1	50	−8	29.4	0.90	9.0
Carlin *1	45	0	27.3	1.90	19.0
Carson City	56	6	34.4	5.75	14.9
Cranes Ranch				1.25	
Dyer	57	−6	32.3	T.	
Elko	49	−12	24.2	3.90	29.0
Fallon	60	6	31.7		
Geyser	50	−10	27.8	1.05	2.5
Golconda	42	2	27.6	1.50	15.0
Halleck				2.40	24.0
Hazen [c]	52	3	29.3	0.21	2.0
Humboldt	47	18	28.6	0.91	6.8
Lewers Ranch	53	8	34.6	14.33	20.0
Lovelocks	55	5	30.6	0.75	6.0
Martins	64	5	38.8	3.10	5.0
Morey	57	3	29.8	1.92	11.6
Palisade	52	−10	28.3	0.54	3.5
Palmetto	57	−4	30.4	0.48	
Pioche	57	−2	25.6	0.92	2.0
Potts	44	−15	22.6	0.81	9.5
San Jacinto	48[e]	−10	26.6[d]	1.46	19.0
Tecoma	48	1	23.2	2.00	20.0
Verdi *1	62	8	29.5	4.72	13.0
Nevada—Cont'd.					
Wabuska	66	5	32.6	0.58	
Wadsworth	59	0	33.5	2.28	2.5
Wells	47	−14	23.5	3.50	29.0
Wood	43	−13	22.2	3.30	46.8
New Hampshire.					
Alstead	57	−4	27.0	2.55	19.5
Bartlett				2.67	13.0
Berlin Mills	60	−5	33.6	1.99	
Bethlehem	60	−9	23.4	1.29	1.5
Bretton Woods				0.40	
Brookline *1	65	−4	31.2	2.61	6.6
Durham	66	0	29.0	6.50	
Franklin Falls	57	−1	26.6	2.27	9.8
Grafton	60	−5	25.8	1.36	7.0
Hanover	57	−13	25.2	1.26	7.4
Keene	60	−7	27.8	2.14	10.2
Littleton	65	−9	23.4	1.45	6.0
Newton	67	1	29.8	2.52	6.0
North Woodstock				3.92	
Plymouth	55	−5	25.3	2.42	10.1
New Jersey.					
Asbury Park	60	8	37.4	2.98	6.7
Bayonne	67	11	36.4	3.28	3.7
Belvidere	68	3	34.8	2.31	3.0
Bergen Point	67	9	35.8	3.59	4.5
Beverly	72	4	37.3	3.34	0.6
Bridgeton	74	6	39.3	3.40	2.5
Browns Mills	73	2	37.2	2.33	1.2
Cape May C. H.	66	13	39.8	2.72	3.0
Charlotteburg	67	2	33.3	2.65	2.0
Clayton	74	5	38.4	3.22	2.0
College Farm	71	2	35.9	3.04	0.7
Dover	64	5	32.5	2.90	5.0
Elizabeth	67	10	36.8	2.90	1.5
Englewood	61	6	34.1	3.02	4.5
Flemington	70	2	35.5	3.86	2.0
Friesburg	70	4	38.2	2.83	1.5
Imlaystown	72	6	41.0	2.20	3.5
Indian Mills	74	0	38.0	3.13	3.2
Jersey City	61	11	37.2	3.36	3.3
Lakewood	70	5	37.6	3.05	5.0
Lambertville	70	6	36.7	3.00	2.5
Layton	65	−5	31.0	2.19	3.0
Moorestown	72	5	37.2	2.85	2.3
Newark	66	9	36.1	2.36	2.3
New Brunswick	69	7	37.2	3.17	3.3
Newton	66	−3	33.7	2.74	4.0
Oceanic	64	9	36.9	2.78	6.2
Paterson	65	12	36.8	2.67	2.8
Phillipsburg	67	7	34.8	2.78	3.6
Plainfield	70	5	35.6	2.77	2.8
Rancocas				2.88	1.8
Rivervale	66	−2	34.0	2.04	4.0
Sandy Hook	65	13	36.7	3.29	5.0
Somerville	66	3	35.0	2.90	2.5
South Orange	67	8	37.1	2.68	2.5
Sussex	67	−1	33.9	2.58	4.5
Toms River	73	2	37.5	2.48	7.0
Trenton	72	10	39.8	3.59	0.3
Tuckerton	63	−2	36.3	2.90	4.0
Vineland	71	1	38.0	2.26	2.5
Woodbine	67	3	38.8	3.13	3.0
New Mexico.					
Alamagordo	70	11	40.8	0.85	8.5
Albert	68	11	41.1	0.20	2.0
Albuquerque	65	−4	35.8	0.20	2.0
Alma	66[b]	13[b]	39.1[b]	0.10	
Alto				0.68	6.0
Artesia	75	5	40.0	0.35	4.1
Bellranch	69	3	37.6	0.25	2.8
Bloomfield	60	−3	29.1	0.19	2.0
Brice	71	16	40.6	0.71	3.7
Carlsbad	77	11	42.6	0.67	6.5
Casasalazar				0.30	3.0
Chama				2.10	21.0
Cimarron	66	−2	33.9	0.05	0.7
Cliff	68	11	38.8	0.34	1.0
Cloudcroft	54	−10	26.4	1.00	11.2
Datil	55	−11	28.2	0.35	4.2
Deming	70	9	37.2	0.66	6.0
Dorsey	63	−1	34.5	T.	T.
Eagle Rock Ranch	59	−7	31.4	0.57	7.8
Elizabethtown	48	−16	20.2	0.58	5.5
Elk	69	9	38.6	0.91	11.0
Espanola	71[f]	−4[c]	29.8[d]	T.	T.
Estancia	62	−16	30.0	0.08	1.0
Fairview				0.30	3.0
Fort Bayard	66	9	37.1	0.41	0.2
Fort Stanton	64	0	33.0	0.35	4.0
Fort Union	63	−9	31.4	0.07	1.0
Fort Wingate	57	−10	29.5	0.45	5.5
Fruitland	55	−1	29.8	T.	T.
Gallinas Spring	64	−7	32.0	0.71	7.4
Gran Quivira				0.25	4.4
Hillsboro	64	6	38.2	0.65	7.0
Hope				0.50	5.0
Laguna				0.03	0.5
Lagunita	65	2	35.3	0.41	3.5
New Mexico—Cont'd.					
Lake Valley				0.68	9.5
Las Vegas	63	−6	33.0	0.04	0.5
Lordsburg	69	18	41.3	0.15	
Los Alamos				0.13	2.0
Los Lunas	64	3	30.4	0.12	1.0
Luna	52	−18	26.9	0.70	7.0
Magdalena				0.03	0.5
Manuelito				0.40	4.0
Maxwell				0.07	0.8
Mesilla Park	76	9	39.6	0.81	
Mimbres				0.32	2.0
Mineral Hill				0.39	4.5
Monument	77[a]	12[a]	43.8[a]	0.26	3.0
Mountainair	53	0	29.0	0.40	4.6
Nara Visa	69	10	41.4	0.46	4.0
Palma				0.00	
Patterson				0.39	3.5
Portales	71	6	38.0	0.56	5.2
Raton	63	−1	32.2	0.03	0.3
Redrock				0.38	1.0
Rincon	73	16	39.4	0.45	4.5
Rociada	60	−14	27.4	0.34	5.0
Rosa				1.10	11.0
Rosedale	53	4	32.4	0.10	1.0
San Marcial	69	8	36.0		
San Rafael	55	−16	28.6	0.24	3.0
Socorro	70	8	35.2	0.49	5.5
Strauss				0.68	7.0
Taos	58	−10	27.7	0.26	3.0
Tres Piedras	52	−19	20.6	0.70	8.0
Tucumcari	67	11	39.4	0.70	7.0
Valley				0.20	2.0
Vermejo	65	−8	30.8	T.	T.
Waldo				0.32	3.5
Weed				0.60	6.5
Whiteoaks				0.64	8.5
Windsor	58	−16	27.8	0.80	
New York.					
Adams	67	−10	30.0	2.12	14.0
Addison	71	−2	33.4	0.90	1.3
Akron				1.50	
Amsterdam				1.63	8.0
Angelica	63	2	30.4	1.59	9.0
Appleton	70	6	33.1	0.95	
Arcade	65	−12	28.1	4.00	22.0
Athens	62	3	32.8	1.79	1.0
Atlanta	64	−7	30.6	0.45	T.
Atwater				1.09	2.8
Auburn	70	5	32.0	0.96	4.5
Avon	68	2	32.0	0.86	4.7
Baldwinsville	68	1	30.3	2.86	14.0
Ballston Lake	61	−2	29.4	1.53	3.9
Bedford	60	4	35.0	1.94	1.2
Berlin	62	−4	30.2	2.32	6.0
Blue Mountain Lake				2.75	18.5
Bolivar	67	−7	30.9	2.02	8.8
Bouckville				3.47	15.5
Brockport	69	1	31.8	1.56	8.5
Cape Vincent	62	−2	28.9	1.97	
Carmel	55	2	30.3	2.59	2.5
Carvers Falls	60	−10	27.4	2.37	7.0
Chatham	65	−1	32.6	1.43	3.0
Chazy	58	−9	25.6	0.85	5.0
Coeymans	62	2	32.0	0.52	2.0
Cold Spring Harbor	58	5	34.2	4.49	1.7
Cooperstown	62	−2	28.4	2.34	7.5
Cortland	68	2	32.0	1.57	4.7
Cutchogue	60	11	35.8	2.62	7.0
Dannemora	58	−7	24.4	0.47	2.4
Dekalb	68	−12	27.0	1.49	8.0
De Ruyter	64	2	29.2	2.31	10.1
Easton				1.85	5.0
Elba	70	2	31.8	1.11	1.2
Elmira	72	5	33.6	0.89	0.5
Faust	59	−26	22.5	1.70	21.0
Fayetteville	68	−2	30.9	2.06	5.0
Fort Plain	54	3	30.4	1.73	5.5
Franklinville	68	−10	29.4	2.10	16.0
Gabriels	62	−23	22.6	0.70	3.0
Gansevoort				3.47	10.5
Glens Falls	60	−3	28.9	1.99	10.5
Gloversville	50	−6	26.8	2.90	20.0
Greenfield	60	−7	28.2	2.30	9.0
Greenwich	64	−2	29.8	1.59	4.0
Griffin Corners	65	−6	29.0	1.39	5.0
Harkness	64	−7	26.5	0.54	1.5
Haskinville				1.01	3.2
Hemlock	62	6	31.2	0.39	
Hunt	69	−5	30.6	2.35	16.5
Indian Lake	62	−21	23.6	1.91	
Ithaca	70	4	31.8	1.07	2.7
Jamestown	72				10.3
Jeffersonville	63	0	31.0	1.76	
Keene Valley	62	−15	26.6	2.09	6.8
Lake George	60	−4	28.0	2.44	11.0
Le Roy	70	2	31.4	1.47	9.5
Liberty	62	−2	28.7	2.36	1.5
Littlefalls, City Res.	62	−3	27.9	1.99	11.0

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lockport	69	4	32.2	1.13	.....
Lowville	60	—18	24.6	2.29	18.0
Lyndonville	.....	.....	.....	1.13	8.2
Lyons	70	5	33.0	2.56	9.5
Middletown	65	6	32.8	2.05	3.5
Mohonk Lake	60	2	30.8	2.96	3.0
Moira	71	— 6	24.5	2.05	12.0
Mount Hope	59	2	33.7	3.07	2.5
Newark Valley	.....	.....	.....	1.51	2.0
New Lisbon	63	—10	28.2	2.02	5.0
North Hammond	65	— 8	26.3	2.24	7.0
North Lake	58	—27	18.8	.....	.....
Ogdensburg	65	—10	26.8	1.07	9.0
Oneonta	72	— 2	32.1	1.14	5.0
Oriskany Falls	68	0	30.6	2.31	9.5
Otto	68	1	32.2	0.43	.....
Oxford	61	3	30.6	2.11	10.0
Oyster Bay	58	11	35.9	2.95	4.5
Palermo	.....	.....	.....	2.21	8.2
Perry City	68	— 6	29.4	1.13	5.1
Plattsburg	56	— 4	26.8	1.10	T.
Port Jervis	67	0	32.4	2.00	3.0
Potsdam	65	—10	26.0	2.12	13.0
Richland	65	— 9	27.4	3.50	11.0
Richmondville	66	— 3	31.1	1.84	8.0
Ridgeway	70	5	32.8	1.86	7.5
Ripley	72	1	34.2	0.50	10.0
Romulus	70	8	33.2	1.41	2.1
Salisbury Mills	65	— 6	28.7	2.10	2.0
Saranac	65	—19	24.2	1.94	13.2
Scarsdale	58	2	34.2	2.10	2.0
Setauket	63	12	36.4	3.56	3.5
Shortsville	70	5	31.6	1.16	4.2
Skaneateles	.....	.....	.....	2.12	.....
Southampton	56	11	36.0	3.79	6.5
South Canisteo	68	4	31.0	1.54	6.5
South Kortright	65	— 7	30.4	1.88	4.0
South Schroon	56	—12	25.5	2.08	15.2
Spier Falls	60	— 5	28.8	1.79	10.5
Taberg	63	— 9	28.6	4.02	19.5
Ticonderoga	.....	.....	.....	1.10	2.5
Volusia	68	4	31.0	1.11	8.0
Wappinger Falls	63	1	32.7	3.07	5.5
Warwick	.....	.....	.....	1.71	3.0
Watertown	66	— 7	29.4	1.82	7.0
Waverly	71	— 2	33.2	1.38	2.0
Wedgwood	67	0	30.2	0.94	2.5
West Berne	70	— 2	30.8	0.66	2.0
Westfield	71	— 1	32.4	1.65	7.0
Windham	65	— 4	30.6	1.49	3.5
Youngstown	.....	.....	.....	1.05	4.5
North Carolina.					
Battleboro	.....	.....	.....	3.93	0.8
Beaufort	71	27	50.0	6.73	0.1
Brevard	64	11	40.3	12.50	6.0
Brewers	65	12	41.0	6.82	3.0
Bryson City	.....	.....	.....	6.41	T.
Buck Springs	56	3	34.1	16.31	17.0
Caroleen	68	16	43.0	8.52	3.0
Catawba	.....	.....	.....	7.78	
Chalybeate Springs	75	18	46.0	4.04	T.
Chapelhill	74	19	43.7	5.00	
Eagletown	73	20	43.7	3.19	0.6
Edenton	72	25	47.2	4.30	.....
Fayetteville	78	20	48.6	4.05	T.
Goldsboro	77	22	45.2	3.53	
Graham	.....	.....	.....	5.26	
Greensboro	71	18	43.9	6.27	
Greenville	.....	.....	.....	4.73	1.5
Henderson	74	22	43.8	2.94	
Hendersonville	65	12	41.4	12.40	10.0
Horse Cove	60	17	40.4	12.94	3.5
Hot Springs	67	16	44.8	.....	.....
Jefferson	64	9	35.4	7.72	7.1
Kinston	79	21	48.0	3.68	1.0
Lenoir	65	10	43.6	8.50	.....
Lexington	70	13	42.0	7.41	
Lincolnton	70	13	43.4	5.11	2.0
Linville	60	4	36.2	.....	.....
Louisburg	75	17	45.0	3.84	T.
Lumberton	78	19	46.8	4.10	T.
Manteo	73	28	48.5	5.71	T.
Marion	68[e]	18[e]	43.8[e]	10.21	13.0
Marshall	69	18	38.7	5.45	7.0
Moncure	76	15	44.5	4.44	
Monroe	75	13	44.4	5.14	
Morganton	68	11	44.5	7.22	8.5
Mountairy	66	11	40.6	5.96	1.5
Mount Holly	.....	.....	.....	8.28	
Murphy	.....	.....	.....	8.60	2.0
Nashville	77	17	46.0	4.63	T.
Newbern	77	23	48.0	7.62	T.
Patterson[a, 1]	65	13	38.0	7.77	6.2
Pinehurst	77	22	49.0	3.84	
Pink Beds	63	4	35.6	16.87	11.5
Pittsboro	71	15	44.3	4.69	T.
Randleman	.....	.....	.....	4.82	
Reidsville	70[d]	18[d]	42.0[d]	6.68	4.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Rockingham	76	17	47.6	3.22	
Salem	68	12	42.1	.....	.....
Salisbury	70	14	42.2	6.99	
Sapphire	60	11	39.0	9.36	13.7
Saxon	70	13	42.4	5.93	2.0
Scotland Neck	77	23	47.4	3.46	0.5
Selma	79	20	46.6	4.20	1.0
Settle	67	13	43.9	6.84	1.0
Sloan	78	19	48.4	3.95	0.1
Snowhill	77	17	47.3	3.14	T.
Southern Pines	77	21	46.9	4.01	
Southport	76	23	50.1	4.80	T.
Statesville	70	11	42.3	7.23	
Tarboro	81	20	46.0	3.29	0.8
Vade Mecum	68	10	39.4	5.88	2.0
Washington	76	19	47.4	4.80	2.0
Waynesville	67	11	40.2	7.83	22.3
Weldon	77	18	43.4	2.77	0.1
Whiteville	76	18	48.1	4.77	T.
North Dakota.					
Amenia	42	—26	12.2	1.20	12.0
Ashley	37	—25	17.0	0.60	6.0
Berlin	39	—28	11.2	0.40	4.0
Bottineau	40	—19	10.4	0.88	8.8
Buford	42	—25	13.4	0.95	9.5
Cando	36[e]	—32[e]	7.2[e]	0.82	8.4
Chilcot	48	—23	15.6	0.53	5.3
Coalharbor	38[e]	—14[e]	16.0[e]	0.20	2.0
Dickinson	46	— 20	16.0	0.65	6.5
Donnybrook	46	—23	12.3	0.60	6.0
Dunseith	47	—32	8.4	0.70	7.0
Edgeley	41	—23	15.4	0.13	1.3
Edmore	45	—30	9.0	1.25	12.5
Ellendale	54	—14	19.8	0.23	2.3
Fargo	37	—27	12.5	0.62	6.2
Flasher	42	—25	14.0	0.09	0.9
Forman	40	—23	15.2	0.50	5.0
Fort Berthold	43	— 24	13.8	0.20	2.0
Fort Yates	43	—20	16.2	0.25	2.2
Fullerton	38	—26	13.3	1.17	11.7
Glenullin	39	—15	15.2	0.57	5.5
Grafton	40	—28	8.7	0.20	2.0
Hamilton	42	—27	6.7	0.84	8.4
Hannah	35	—31	7.4	0.30	3.0
Hillsboro	38	—29	11.5	0.90	9.0
Jamestown	47	—25	17.7	0.66	6.6
Kulm	40	—22	14.5	0.60	6.5
LaFollette	50	—28	14.0	0.91	9.1
Larimore	40	—24	10.4	0.80	8.0
Lisbon	37	—27	12.9	0.25	2.5
McKinney	40	—26	9.6	0.70	7.0
Manfred	51	—26	12.7	1.20	12.0
Mayville	41	—27	11.4	0.60	6.0
Medina	.....	.....	.....	0.80	8.0
Melville	40[c]	—20[c]	14.6[e]	0.70	7.0
Minnewaukon[k]	36	—25	10.8	.....	.....
Minot	59	—30	11.7	0.76	7.6
Minto	38[e]	—25[e]	10.9[e]	0.34	3.4
Moyersville	36	—25	10.0	.....	.....
Napoleon	35	—25	10.7	0.65	8.0
New England	57	—23[b]	18.2[d]	0.60	6.0
Oakdale	58	—20	20.4	0.35	3.5
Oriska	39	—25	14.2	1.35	13.5
Park River	40	—23	9.0	0.42	4.2
Pembina	44	—28	7.4	1.25	12.5
Portal	36	—28	9.0	0.80	8.0
Power	42	—30	11.0	0.66	6.6
Pratt	37	—32	6.8	1.40	14.0
Rolla	44	—25	7.5	1.33	13.3
Rugby	36[f]	—32[f]	7.7[f]	1.00	10.0
Sentinal Butte	45	—20	18.8	0.20	2.0
Steele	38	—25	10.9	0.20	2.0
University	37	—29	10.4	0.70	7.0
Wahpeton	39[e]	—24[e]	13.6[e]	1.00	10.0
Walhalla	.....	.....	.....	0.71	7.1
Washburn[f]	43	—23	16.6	.....	.....
Willow City	36	—38	6.0	1.60	16.0
Wishek	36	—24	13.0	.....	.....
Ohio.					
Akron	73	7	34.7	0.96	2.2
Amesville	75	— 9	36.8	3.61	8.3
Atwater	.....	.....	.....	1.42	1.0
Bellefontaine	71	— 2	33.8	2.08	2.7
Benton Ridge	71	10	35.2	6.97	0.9
Bladensburg	73	— 9	34.6	2.74	8.0
Bowling Green	72	10	34.7	0.72	1.5
Bucyrus	76	0	35.8	1.85	3.0
Cadiz	73	4	35.8	2.18	3.7
Cambridge	76	— 6	36.8	2.50	6.0
Camp Dennison	75	—12	36.2	3.61	5.4
Canal Dover	72	— 6	35.0	2.17	3.0
Canton	70	7	35.2	1.23	3.3
Cardington	71	— 8	34.1	1.05	3.5
Circleville	75	— 5	35.6	2.89	7.0
Clarington	76	6	38.4	2.93	6.0
Clarksville	74	— 5	36.8	3.57	10.0
Cleveland *b*	72	10	35.6	1.71	6.0
Coalton	76	— 9	36.8	2.47	6.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Colebrook	66	6	32.2	1.19	2.5
Dayton	75	— 4	36.0	2.96	7.9
Defiance	69	10	35.3	1.23	2.0
Delaware	73	— 3	35.0	1.46	3.6
Demos	73	7	36.2	2.75	5.2
Findlay	74	11	35.4	1.19	0.7
Frankfort	74	—10	36.8	2.57	10.0
Fremont	73	12	36.3	0.84	2.0
Garrettsville	74	9	34.2	1.45	3.5
Granville	73	—10	35.4	2.42	6.0
Gratiot	72	— 6	35.0	3.01	5.9
Green	76	— 1	38.0	2.45	4.0
Greenhill	72	6	34.1	1.52	2.1
Greenville	70	— 3	34.8	2.42	4.5
Hedges	70	6	31.4	1.52	2.0
Hillhouse	71	13	34.2	1.06	2.0
Hiram	70	8	34.0	1.31	8.5
Hudson	71	5	33.2	1.18	0.2
Ironton	79	5	40.7	3.34	3.7
Jacksonburg	75	0	36.3	3.89	12.0
Killbuck	72	5	34.8	1.88	3.7
Lancaster	73	— 4	37.2	2.67	8.0
Lima	77[d]	5[g]	35.7[f]	1.25	3.0
McConnelsville	75	0	36.6	3.40	8.2
Manara	71	— 6	34.8	2.78	6.5
Mansfield	.....	.....	.....	2.10	5.0
Marietta	72	8	38.9	2.88	5.5
Marion	74	3	35.2	0.95	3.4
Medina	72	— 1	34.4	1.54	3.0
Milfordton	71	4	33.6	1.58	4.0
Milligan	74	—11	35.8	3.06	6.0
Millport	71	7	34.3	1.99	3.5
Napoleon	70	11	36.1	0.98	1.5
Nellie	72	0	35.2	1.76	3.0
New Alexandria	73	6	36.4	2.10	.....
New Berlin	70	3	34.3	1.05	1.0
New Bremen	72	0	34.4	0.81	2.5
New Richmond	74	3	37.6	2.53	1.4
New Waterford	71	6	34.4	1.84	5.0
North Lewisburg	72	1	34.4	2.60	6.9
North Royalton	71	6	34.2	2.75	2.5
Norwalk	72	6	36.5	1.22	1.0
Oberlin	73	7	35.4	1.10	2.6
Ohio State University	72	— 3	35.0	2.03	4.9
Orangeville	75	7	32.6	1.55	T.
Ottawa	71[i]	10	35.2	1.04	T.
Pataskala	73	— 3	35.0	2.72	7.7
Philo	73	6	36.8	1.65	7.5
Plattsburg	72	— 3	34.9	2.48	7.0
Pomeroy	72	3	39.2	2.93	1.2
Portsmouth	75	5	39.5	3.02	3.0
Pulse	74	—14	36.2	2.78	5.0
Rittman	74	2	34.6	1.20	0.5
Rockyridge	73	11	35.2	1.01	1.3
Shenandoah	70	5	34.0	1.12	1.2
Sidney	72	1	35.8	1.92	3.7
Somerset	72	1	36.4	3.11	10.0
South Lorain	74	8	34.6	1.24	2.2
Springfield	.....	.....	.....	2.60	6.1
Thurman	75	3	40.2	3.11	5.0
Tiffin	71	12	35.8	0.87	0.5
Toledo (St. Johns College)	68	13	34.5	1.05	2.7
Upper Sandusky	72	6	35.9	1.37	4.0
Urbana	74	—11	34.0	1.54	9.5
Vickery	73	10	35.5	0.91	2.7
Warren	74	9	34.8	1.31	3.4
Wauseon	68	11	33.7	1.68	3.0
Waverly	78	— 1	37.8	2.97	4.0
Waynesville	72	— 3	35.8	3.09	10.0
Wellington	71	8	35.9	0.79	2.5
Willoughby	.....	.....	.....	0.97	.....
Wilson	76	—11	36.8	2.91	3.0
Wooster	72	6	35.9	1.93	4.2
Zanesville	.....	.....	.....	2.71	6.0
Oklahoma.					
Alva	73	12	41.1	1.17	4.0
Arapaho	77	9	41.4	0.61	1.5
Blackburn	72	7	39.4	1.10	0.4
Chattanooga	70	13	43.8	0.04	0.2
Enid	72	10	38.8	1.10	2.0
Erick	76	11	42.6	0.90	1.0
Fort Reno	73	0	35.7	.....	.....
Fort Sill	70	10	41.5	0.90	5.0
Gage	78	9	38.6	0.65	5.0
Grand	76	10	39.6	0.26	1.2
Guthrie	75	8	41.8	0.78	1.0
Harrington	75	9	41.1	0.30	T.
Helena	74	12	40.8	0.18	T.
Hennessey	74	12	42.3	0.98	3.0
Hobart	76	9	42.7	1.18	3.2
Jefferson	75	9	38.8	0.30	.....
Jenkins	75	12	39.9	0.85	4.0
Kenton	70	— 1	39.0	0.40	3.0
Kingfisher	74	12	41.0	0.89	1.0
Mangum	77	18	41.2	0.60	1.0
Meeker	75	16	46.1	2.44	T.
Neola	77	11	40.8	1.45	2.0
Newkirk	69	10	39.3	0.85	.....

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Oklahoma—Cont'd.	°	°	°	*Ins.*	*Ins.*
Norman	75	10	41.6	1.04	1.2
Okmulgee	76	15	39.7	2.15	10.0
Perry	73	12	40.6	0.99	0.5
Shawnee	85	8	42.5	1.09	.....
Stillwater	74	11	38.4	0.95	1.0
Taloga	.....	.....	.....	0.61	3.0
Temple	81	11	44.8	0.49	3.0
Watonga	68	7	38.5	0.83	2.0
Waukomis	73	13	42.3	1.06	1.0
Whiteagle	72	9	39.6	1.04	0.5
Oregon.					
Alba	.....	.....	.....	1.21	
Albany	.....	.....	.....	5.76	0.2
Alpha	62	30	44.4	13.83	1.0
Arlington	57	16	37.2	.....	.....
Ashland	66	20	39.0	6.28	19.1
Astoria	57	31	43.5	8.91	T.
Aurora (near)	57	29	42.0	4.67	
Bay City	60	31	44.0	11.58	
Bend	57	0	32.7	0.97	18.5
Beulah	39	0	18.6	3.90	39.0
Blackbutte	54	27	39.2	4.55	5.0
Blalock	56	19	38.6	1.25	5.0
Bullrun	.....	.....	.....	8.07	2.0
Burns	45	— 4	23.4	4.24	33.0
Carlton	61	28	40.9	5.91	
Cascade Locks	55	26	39.4	7.84	.....
Coquille	.....	.....	.....	5.74	
Corvallis	58	28	43.4	7.22	1.0
Dale	.....	.....	.....	1.74	8.0
Dayville	61	16	38.3	2.04	5.2
Doraville	61	27	40.1	6.09	14.9
Drain	68	31	44.6	5.69	
Echo	61	13	37.8	0.66	3.3
Ella	55	15	35.4	1.53	14.5
Eugene	63	29	43.4	5.01	T.
Fairview	74	30	46.9	8.38	1.0
Falls City	54	26	41.2	12.11	2.6
Forestgrove	58	27	40.6	7.80	3.0
Gardiner	67	31	46.2	9.74	
Glendale	65	27	39.7	13.41	3.0
Glenora	55	30	39.9	19.78	16.0
Gold Beach	66	31	46.6	8.53	T.
Granite	.....	.....	.....	2.82	.....
Grants Pass	63	26	39.2	8.85	4.5
Grass Valley	58	10	35.6	1.00	6.0
Heisler	58	15	37.7	0.97	3.2
Hood River	52	26	37.8	2.82	27.5
Huntington	43	2	23.8	2.63	21.0
Jacksonville	65	24	38.1	7.14	6.5
John Day	52	6	35.0	2.13	13.0
Joseph	46	5	25.2	1.50	15.0
Kerby	65	25	39.0	16.07	8.0
Klamath Falls	48	0	28.0	5.90	39.5
Lagrande	52	5	31.1	0.85	3.5
Lakeview	46	— 2	26.4	4.63	29.0
Lonerock	60	2	34.2	1.05	.....
McKenzie Bridge	64	21	37.0	7.45	5.0
McMinnville	60	29	42.2	6.02	4.2
Marshfield	67	29	45.6	7.41	0.1
Meacham	.....	.....	.....	2.24	18.5
Monroe	60	26	43.3	7.66	
Mount Angel	58	28	43.0	6.17	
Nehalem	.....	.....	.....	11.82	0.8
Newport	61	33	46.2	6.93	
Odell	.....	.....	.....	2.54	
Ontario	.....	.....	.....	0.70	6.5
Orseco	61	16	36.0	10.51	59.0
Paisley	50	12	33.2	.....	.....
Pendleton	59	15	37.8	0.98	3.5
Port Oxford	70	34	47.6	7.54	
Prineville	51	8	35.2	0.75	
Prospect	48	10	30.8	6.50	20.5
Richland[4]	47	— 2	26.4	.....	4.0
Riverside	.....	.....	.....	2.15	14.0
Salem	56	30	43.6	5.42	
Silverlake	48[e]	— 5[e]	29.2[e]	1.98	10.5
Sparta	38	5	21.2	2.80	28.0
Stafford	58	30	41.1	6.01	
The Dalles	56	21	38.6	1.90	14.2
Toledo	68	31	45.8	9.10	
Umatilla	63	20	37.3	0.60	1.6
Vale	46	— 4	25.4	1.60	16.0
Van	.....	.....	.....	4.22	26.5
Wallowa	49	— 4	24.5	1.48	18.2
Wamic	64	7	35.6	1.15	14.0
Warm Spring	64	11	38.1	1.25	7.5
Williams	70	21	41.2	8.57	7.0
Pennsylvania.					
Aleppo	75	— 2	36.7	3.20	7.0
Altoona	70	5	33.0	2.63	T.
Beaver Dam	.....	.....	.....	2.44	1.5
Bellefonte	70	7	35.6	1.79	5.0
Brookville	.....	.....	.....	3.08	4.8
Browers	.....	.....	.....	3.23	1.8
California	78	3	38.5	1.77	5.0
Cassandra	66	5	32.0	2.35	8.0
Centerhall	67	5	33.6	2.10	3.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Pennsylvania—Cont'd.	°	°	°	*Ins.*	*Ins.*
Clarion	.....	.....	.....	2.68	4.2
Claysville	76	— 3	36.8	1.93	3.5
Clearfield	.....	.....	.....	2.56	2.0
Coatsville	72	8	37.1	3.54	2.7
Confluence	.....	.....	.....	4.30	7.0
Davis Island Dam	.....	.....	.....	2.07	2.3
Derry	83	— 4	38.6	2.67	5.0
Doylestown	.....	.....	.....	4.68	
Dushore	65	— 2	31.1	1.07	3.9
East Mauch Chunk	66	3	34.4	2.81	5.0
Easton	66	5	35.3	2.70	3.3
Ellwood Junction	.....	.....	.....	2.13	0.6
Emporium	67	4	33.0	3.28	6.2
Ephrata	65	5	33.6	2.55	4.2
Everett	72	1	33.6	2.56	6.5
Forks of Neshaminy	.....	.....	.....	2.81	0.6
Franklin	73	3	33.8	2.29	3.0
Freeport	85	4	35.8	2.83	2.4
Gettysburg	67	3	36.1	2.93	5.0
Girardville	.....	.....	.....	3.74	7.0
Gordon	68	0	33.6	3.05	6.0
Greensboro	.....	.....	.....	3.54	7.0
Greenville	72	10	34.0	1.56	5.2
Hamburg	66	5	36.0	2.36	3.5
Hanover	70	10	39.2	2.70	4.0
Herrs Island Dam	.....	.....	.....	2.15	3.5
Huntingdon	71	0	35.8	2.79	3.0
Hyndman	.....	.....	.....	2.33	3.4
Indiana	75	1	34.6	1.77	4.0
Irwin	79	4	39.4	2.39	3.3
Johnstown	78	8	35.6	3.57	4.5
Keating	.....	.....	.....	2.32	5.0
Lansdale	.....	.....	.....	2.69	.....
Lawrenceville	71	— 1	33.6	0.76	0.5
Lebanon	65	4	36.0	3.33	6.6
Leroy	67	— 3	31.2	1.24	4.2
Lewisburg	67	1	35.4	2.61	5.6
Lockhaven	70	4	36.5	1.83	2.6
Lock No. 4	.....	.....	.....	2.39	0.6
Lycippus	74	6	37.1	2.57	6.4
Marion	70	4	36.2	2.62	4.0
Mifflintown	68	2	34.6	1.92	4.8
Milford	64	— 2	32.2	1.94	4.6
Montrose	62	— 3	29.5	1.61	2.5
New Germantown	70	2	36.0	1.87	4.0
Ottsville	.....	.....	.....	2.30	
Parker	.....	.....	.....	2.72	3.0
Penmar	.....	.....	.....	1.23	3.2
Philadelphia	71	14	40.4	3.68	2.2
Pocono Lake	66	2	30.3	1.79	3.0
Point Pleasant	.....	.....	.....	2.96	
Pottsville	.....	.....	.....	2.50	.....
Reading	71	5	37.3	3.72	3.7
Renovo	.....	.....	.....	2.03	4.0
Saegerstown	72	0	33.2	1.63	6.0
St. Marys	62	1	30.2	2.96	15.0
Saltsburg	.....	.....	.....	1.54	4.8
Seisholtzville	.....	.....	.....	3.11	
Selinsgrove	66	1	36.8	3.09	4.5
Shawmont	.....	.....	.....	2.63	
Skidmore	72	5	34.2	1.67	1.0
Smiths Corners	.....	.....	.....	3.13	
Somerset	69	2	31.9	5.28	8.7
South Eaton	68	3	35.0	1.97	2.5
Springdale	.....	.....	.....	2.61	2.5
Springmount	.....	.....	.....	2.90	
State College	67	6	32.6	2.30	3.3
Towanda	70	1	33.2	1.22	3.3
Uniontown	78	8	38.4	4.35	10.0
Warren	72	2	32.8	1.95	7.1
Wellsboro	66	— 4	30.4	.....	.....
Westchester	68	9	37.4	3.76	2.0
West Newton	.....	.....	.....	2.14	7.0
Wilkesbarre	66	4	35.4	1.17	5.5
Williamsport	66	7	35.8	1.51	1.8
Rhode Island.					
Bristol	53	10	34.6	3.38	6.5
Kingston	62	— 3	33.0	5.16	9.0
Pawtucket	67	13	39.2	3.66	3.3
Providence	64	8	35.2	3.01	7.5
South Carolina.					
Aiken	78	25	48.4	5.25	1.0
Allendale	76	26	49.6	5.35	
Anderson	68	22	44.9	8.06	1.6
Barksdale	71[j]	27[j]	47.6[j]		3.0
Batesburg	77	23	45.9	6.90	1.0
Beaufort	77	28	52.8	5.70	
Bennettsville	78	26	48.0	3.52	
Blackville	79	22	48.8	3.88	
Blair	.....	.....	.....	6.54	
Bowman	78	22	49.0	5.18	
Calhoun Falls	.....	.....	.....	7.80	
Camden	.....	.....	.....	4.55	
Chappells	.....	.....	.....	5.62	2.0
Cheraw	77	10	46.4	4.29	
Clarks Hill	76	20[d]	47.8[d]	4.50	T.
Clemson College	79	19	46.2	11.65	
Conway	78	22	49.4	5.48	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Darlington	78	19	48.2	4.54	
Dillon	78	20	48.2	4.23	T.
Due West	71	25	46.4	7.02	
Edisto	.....	.....	.....	4.78	
Effingham	.....	.....	.....	6.75	
Enoree	.....	.....	.....	6.20	
Florence	78	22	47.8	3.63	
Gaffney	70	18	44.2	9.10	3.5
Georgetown	73	26	50.6	5.95	
Greenville	68	15	40.2	10.63	7.7
Greenwood	72	23	43.3	6.09	
Kingstree	80	26	53.3	5.04	
Liberty	68	15	44.4	11.69	6.0
Little Mountain	75	23	46.7	4.09	1.0
Pelzer	.....	.....	.....	9.28	3.5
St. Matthews	75	24	48.0	5.73	
St. Stephens	.....	.....	.....	4.93	
Saluda	77	19	46.7	5.81	3.5
Santuck	74	18	44.3	6.96	2.0
Seivern	80	12	46.2	4.73	1.0
Smiths Mills	.....	.....	.....	3.95	
Spartanburg	69	21	43.0	8.69	5.5
Statesburg	82	22	49.8	4.91	
Summerville	79	23	51.2	4.57	
Trenton	74	26	47.0	5.11	1.5
Trial	79	21	50.0	4.74	
Walhalla	67	19	44.2	10.60	2.0
Walterboro	83	21	51.6	5.70	
Winnsboro	75	30	46.2	5.80	T.
Winthrop College	75	21	45.2	7.28	2.5
Yemassee	77	22	48.7	5.93	
South Dakota.					
Aberdeen	42	—24	16.6	0.54	8.2
Academy	57	—17	23.3	0.99	6.1
Alexandria	59[f]	—18	23.2[e]	0.16	2.0
Armour	61	—22	23.6	0.53	5.3
Ashcroft	51	—13	23.0	0.90	9.0
Bowdle	40	—22	15.5	0.30	3.0
Brookings	53	—16	20.8	0.17	1.7
Canton	57	—17	24.0	0.30	6.0
Castlewood	50	—17	19.8	0.13	.....
Centerville	58	—18	24.2	0.64	6.4
Chamberlain	58	—23	22.6	0.31	.....
Cherry Creek	55	—24	20.7	0.10	1.0
Clark	38	—22	16.4	1.05	10.5
Clear Lake	46	—14	16.8	0.15	.....
Dallas	55	—20	21.2	0.18	.....
Desmet	50	—16	21.0	0.19	2.0
Doland	45	—24	18.1	0.59	6.5
Elkpoint	63	—15	25.4	1.35	10.5
Fairfax	60	—16	24.0	0.35	5.0
Farmingdale	.....	.....	.....	0.06	0.5
Faulkton	49	—19	17.6	0.27	5.0
Flandreau	53	—12	21.4	0.24	2.5
Forestburg	54	—24	18.6	0.82	8.2
Fort Meade	64	—14	26.2	0.30	3.0
Gannvalley	54	—23	20.6	0.50	7.0
Grand River School	44	—31	15.6	.....	.....
Greenwood	64	—12	27.6	0.87	8.7
Hermosa	66	— 9	30.0	0.14	2.5
Highmore	50	—19	20.6	0.30	3.0
Hotch City	58	—25	21.9	0.16	4.0
Howell	46	—23	16.9	0.19	2.6
Howard	58	—17	22.8	0.11	1.1
Ipswich	38	—23	14.5	0.78	6.0
Kidder	42	—23	15.9	0.10	1.0
Kimball	55	—20	21.1	.....	.....
Leola	36	—23	15.7	0.27	5.0
Mellette	48	—25	17.2	.....	.....
Menno	59	—14	24.2	0.26	3.5
Milbank	53	—14	19.8	0.41	3.0
Mitchell	60	—27	20.8	0.30	3.0
Mound City	41	—29	11.5	1.00	10.0
Oelrichs	58	—14	26.2	0.75	7.5
Pine Ridge	60[e]	—13[e]	28.2[e]	0.18	3.5
Ramsey	55	—20	21.2	0.20	2.0
Redfield	43	—22	15.4	0.31	3.8
Rosebud Agency	60	—16	29.2	0.58	5.1
Sioux Falls	57	—13	23.8	0.38	4.0
Spearfish	57	— 8	30.9	0.95	.....
Stephan	52	—22	19.9	0.43	3.2
Tyndall	61	—12	26.6	0.24	2.3
Vermillion	59	—11	25.8	0.42	5.0
Watertown	45[f]	—14[e]	18.1[e]	0.26	3.1
Wentworth	55	—13	22.0	0.12	1.2
Whitehorse	45	—25	17.8	T.	T.
Woolsey	.....	.....	.....	0.50	5.0
Tennessee.					
Andersonville	72	17	42.8	6.50	1.0
Ashwood	73	12	42.2	3.16	1.0
Benton	71	15	43.1	5.01	6.0
Bluff City	.....	.....	.....	4.96	1.7
Bolivar	74	14	40.1	4.30	T.
Bristol	70	11	40.1	4.26	1.0
Brownsville	74	15	41.8	3.00	T.
Byrdstown	72	7	44.1	4.79	6.0
Carthage	73	13	43.3	5.74	1.7
Catlettsburg	.....	.....	.....	4.53	1.7

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cedar Hill	74	12	41.6	3.00	0.5
Celina	.....	.....	.....	4.86	.....
Charleston	.....	.....	.....	4.22	1.0
Clarksville	72	12	42.0	2.62	3.5
Clinton	.....	.....	.....	4.95	1.
Covington	73	17	42.8	5.15	T.
Dandridge	.....	.....	.....	4.17	0.5
Decatur	70	15	42.6	4.60	1.0
Dickson	72	10	41.6	3.06	2.0
Dover	68	9	41.8	2.08	2.0
Dyersburg	75	15	41.8	5.40	T.
Elizabethton	72	12	41.4	3.93	9.0
Erasmus	66	7	38.8	4.12	1.9
Florence	71	12	43.0	5.27	1.0
Franklin	70	12	41.6	4.38	1.0
Greeneville	73	12	41.5	3.82	11.8
Halls Hill	.....	.....	.....	5.46	0.3
Harriman	70	17	41.4	3.96	1.0
Hohenwald	70	4	40.5	2.93	1.5
Iron City	70	14	43.8	5.95	.....
Jackson	75	74	44.4	3.65	.....
Johnsonville	70	10	42.6	3.13	0.8
Jonesboro	75	2	40.5	4.25	10.0
Kenton	75	13	42.6	5.15	1.5
Kingston	.....	.....	.....	3.84	T.
Lafayette	71	45	41.3	4.82	1.5
Leadvale	.....	.....	.....	4.26	4.0
Lewisburg	71	14	43.0	5.56	2.7
Loudon	.....	.....	.....	4.60	.....
Lynnville	69	14	42.4	4.82	T.
McGee	.....	.....	.....	4.07	6.0
McMinnville	71	12	43.0	4.79	5.5
Maryville	73	14	42.7	4.49	2.5
Monterey	67	8	41.0	.....	3.0
Newport	72	11	41.8	4.47	4.0
Palmetto	70	10	42.8	4.98	T.
Pope	75	8	43.6	3.45	1.0
Rogersville	72	15	41.3	4.39	T.
Rugby	67	10	39.4	2.88	4.0
Savannah	72	14	43.4	3.09	0.1
Sevierville	76	9	42.5	3.97	4.0
Sewanee	67	9	40.5	5.35	8.0
Silver Lake	65	8	37.8	7.93	4.5
Sparta	77	12	43.2	3.95	T.
Springdale	74	12	41.0	4.35	1.5
Springville	74	9	42.0	4.70	1.0
Tazewell	.....	.....	.....	4.40	1.7
Tellico Plains	71	14	43.2	4.44	1.0
Tracy City	67	11	40.8	4.96	0.5
Trenton	76	12	42.2	3.76	0.5
Tullahoma	68	12	42.7	5.43	1.5
Union City	75	10	41.9	6.30	.....
Walling	.....	.....	.....	3.91	.....
Waynesboro	71	12	42.2	3.13	0.8
Wildersville	71	13	42.6	4.85	0.5
Yukon	67	14	43.7	6.67	.....
Texas.					
Albany	.....	.....	.....	0.67	2.0
Alvin	.....	.....	.....	1.27	
Arthur	.....	.....	.....	2.21	7.0
Austin	75	26	51.4	0.80	
Ballinger	83	14	46.4	0.35	0.5
Beaumont	83	22	54.7	1.73	
Beeville	85	22	55.1	0.55	
Big Spring	87	12	47.6	0.31	1.5
Blanco	.....	.....	.....	0.32	
Boerne	72	18	45.4	0.40	
Bonham	78	11	44.6	3.50	7.0
Booth	.....	.....	.....	1.08	
Bowie	78	13	46.2	0.60	2.2
Brazoria	.....	.....	.....	1.07	
Brenham	78	27	51.8	1.75	T.
Brighton	75	21	54.5	0.42	
Brownwood	82	14	45.5	0.38	T.
Channing	77	8	39.6	0.20	2.0
Childress	74	13	43.4	0.62	3.0
Clarksville	75	10	43.4	4.65	3.5
Claude	70	12	37.0	0.01	0.2
Coleman	85	17	50.8	0.67	1.0
Colorado	84	10	46.5	0.29	1.5
Columbia	77	21	53.6	1.52	
Columbus	.....	.....	.....	1.40	
Corsicana	78	19	48.6	1.97	5.0
Cotulla	77	20	51.0	T.	
Crockett	79	22	51.2	4.27	0.1
Cuero	78	26	55.1	1.07	
Dalhart	74	−2	42.0	0.10	1.0
Dallas	78	12	44.4	1.98	6.5
Danevang	77	24	52.0	1.25	
Denison	.....	.....	.....	1.85	12.0
Dialville	.....	.....	.....	2.81	0.5
Duval	77	24	51.2	0.93	T.
Eagle Pass	81	20	52.0	T.	
Fort Brown	81	30	59.4	0.24	
Fort Clark	78	25	52.7	0.03	
Fort Davis	76	10	43.4	0.62	8.0
Fort McIntosh	85	21	53.8	0.16	
Fort Ringgold	86	25	59.7	0.00	
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fort Stockton	85	12	46.0	0.52	5.0
Fredericksburg	76	16	47.9	0.52	T.
Gainesville	.....	.....	.....	0.75	5.5
Georgetown	77	16	50.1	0.98	T.
Gonzales	.....	.....	.....	0.90	
Graham	83	10	46.0	0.40	2.0
Grapevine	77	15	46.8	1.12	5.5
Greenville	73	11	43.7	2.40	8.5
Hale Center	69	14	41.0	0.18	3.0
Hallettsville	79	25	53.4	1.59	
Haskell	85	12	44.6	0.32	1.5
Hearne	80	21	49.9	0.80	1.0
Hempstead	.....	.....	.....	4.02	
Henrietta	84	14	43.0	0.28	0.2
Hereford	72	7	39.8	0.35	.....
Hewitt	.....	.....	.....	1.31	5.5
Hillsboro	75	15	47.4	1.34	1.5
Hondo	78	20	50.8	0.27	T.
Huntsville	82	17	49.1	3.45	T.
Jefferson	76	18	47.4	4.11	1.5
Kaufman	76	17	47.6	2.28	3.5
Kent	78	15	46.5	0.60	6.0
Kerrville	80	14	49.8	1.00	0.5
Knickerbocker	82	10	48.1	0.10	T.
Kopperl	.....	.....	.....	0.82	3.0
Lampasas	81	16	46.8	0.88	0.5
La Para	.....	.....	.....	0.00	
Liberty	80	22	54.4	1.40	
Llano	80	20	49.0	T.	
Longlake	.....	.....	.....	1.98	1.3
Longview	77	20	46.2	2.52	T.
Luling	79	23	52.0	0.93	
Marlin	79	22	48.9	1.05	4.8
Mexia	77	20	46.8	1.48	3.4
Miami	76	11	43.4	0.36	2.0
Mount Pleasant	78	14	48.0	2.40	5.5
Nacogdoches	78	19	47.4	4.85	T.
Panter	.....	.....	.....	1.45	.....
Paris	76	9	43.9	3.10	4.0
Pearsall	82	21	53.2	T.	
Port Lavaca	79	26	54.4	0.48	
Quanah	80	19	46.3	0.50	2.0
Rhineland	84	10	42.2	0.70	7.0
Riverside	.....	.....	.....	2.96	
Rock Island	80	26	53.3	1.31	
Rockland	.....	.....	.....	2.00	
Rockport	68	32	54.4	2.00	
Sabinal	82	28	56.6	0.10	
San Marcos	77	21	50.0	0.56	
San Saba	79	12	47.8	0.34	
Santa Gertrude	.....	.....	.....	0.52	
Seymour	84	11	44.4	0.16	2.0
Sonora	79	8	45.6	0.13	T.
Sugarland	88	23	55.0	1.37	
Sulphur Springs	78	13	46.5	2.28	7.0
Temple	76	18	47.6	1.12	T.
Tyler	78	20	46.0	1.31	5.0
Valley Junction	.....	.....	.....	1.64	
Victoria	81	25	54.4	1.34	
Waco	78	22	51.2	1.38	1.0
Weatherford	76	14	45.2	0.89	2.5
Wichita Falls	.....	.....	.....	1.50	
Willspoint	77	14	48.0	3.16	7.0
Utah.					
Alpine	.....	.....	.....	1.93	20.0
Alta	.....	.....	.....	2.49	72.0
Aneth	53	−10	27.3	0.29	.....
Beaver	52	−2	28.8	1.10	11.0
Blacksmith Fork	.....	.....	.....	2.46	23.5
Castledale	44	−15	17.0	1.59	.....
Castle Rock	.....	.....	.....	1.87	19.2
Cedar City	53	3	34.2	0.68	6.6
Clear Creek	.....	.....	.....	2.80	28.0
Corinne	44	−10	22.4	2.10	10.5
Coyoto	52	−21	19.0	2.23	21.0
Deseret	53	−7	27.4	0.31	2.0
Emery	46[1]	5[1]	26.4[1]	1.73	.....
Experiment Farm	67	15	38.4	.....	.....
Farmington	50	3	27.8	2.38	16.6
Fillmore	55	−1	30.8	0.72	.....
Fort Duchesne	41	−18	10.0	0.35	3.5
Frisco	53	5	31.5	0.10	.....
Giles	56	−21	25.2	0.82	7.8
Government Creek	46	3	27.5	0.64	4.0
Grayson	53	1	27.9	3.21	7.5
Green River	52	−3	25.5	.....	.....
Heber	44	−16	20.8	3.10	13.5
Henefer	48	−21	21.4	3.40	17.2
Hite	63	2	33.6	0.74	6.0
Huntsville	.....	.....	.....	3.38	19.0
Ibapah	48	−17	23.3	0.12	1.2
Indianola	.....	.....	.....	0.14	.....
Kanab	54	−15	26.6	4.00	13.0
Kelton *[1]	40	−4	18.9	0.85	8.5
La Sal	53	−3	25.3	1.13	11.3
Levan	45	−6	24.9	1.64	7.4
Loa	45	−23	14.1	1.50	15.0
Logan	54	−15	21.4	2.28	.....
Utah—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lucin	45	−4	21.6	2.00	20.0
Manti	48	−7	24.0	2.48	.....
Marion	.....	.....	.....	2.73	14.5
Marysvale	49	−11	24.6	0.85	6.0
Meadowville	42	−3	21.0	5.45	24.0
Millville	.....	.....	.....	1.59	.....
Moab	56	4	29.7	0.57	0.6
Morgan	49	−20	21.6	2.78	15.5
Mount Nebo	48	−10	26.7	0.92	1.0
Mount Pleasant	52	0	24.8	1.53	7.0
Nephi	.....	.....	.....	1.62	4.5
Oak City	50	−2	28.4	1.09	.....
Ogden	48	−1	25.0	2.12	21.2
Panquitch	.....	.....	.....	0.25	2.0
Park City	44[g]	−8[g]	18.1[g]	4.58	45,8
Parowan	49	−6	26.6	1.40	13.0
Payson	.....	.....	.....	1.15	3.0
Pinto	49	−9	25.9	2.72	.....
Plateau	70	−14	26.4	2.52	25.4
Provo	50	−12	25.9	1.05	6.0
Randolph	.....	.....	.....	1.10	14.5
Richfield	53	−6	28.5	.....	.....
Rockville	64	1	39.0	1.87	.....
St. George	70	11	40.0	0.66	.....
Salt Air	53	−1	26.4	1.13	8.5
Scipio	50	−22	25.6	1.73	5.0
Snowville	47	−13	20.2	1.20	10.0
Soldier Summit	35	−15	17.6	0.38	.....
Strawberry Valley	.....	.....	.....	2.87	30.5
Sunnyside	.....	.....	.....	0.75	7.5
Thistle	52	−8	24.0	.....	.....
Tooele	54	7	28.3	0.66	.....
Tropic	52	3	28.4	0.67	5.0
Trout Creek	55	2	27.9	0.14	.....
Utah Lake	49	−4	24.3	0.90	5.5
Vernal	38	−10	11.3	0.96	8.8
Wellington	48	−14	17.5	1.15	11.5
Vermont.					
Burlington	64	2	31.2	1.00	3.5
Cavendish	55[e]	−7[e]	25.0[e]	1.84	14.6
Chelsea	50	−11	22.6	2.21	18.0
Cornwall	61	0	30.6	1.86	.....
Enosburg Falls	65	−17	25.1	2.05	6.0
Jacksonville	59	−10	26.9	3.36	21.0
Manchester	63	−4	28.4	1.73	8.5
Norwich	57	−15	20.5	2.22	11.5
St. Johnsbury	54	−17	23.6	2.10	11.8
Wells	64	−6	26.2	2.32	7.0
Westfield	.....	.....	.....	2.05	7.0
Woodstock	52	−14	25.0	1.51	18.0
Virginia.					
Arvonia	77	8	40.3	4.14	1.0
Ashland	73	14	41.7	2.36	0.5
Barboursville	71	10	41.8	4.31	3.0
Bigstone Gap	72	8	40.3	3.66	9.0
Blacksburg	65	11	37.0	4.17	0.7
Buchanan	.....	.....	.....	3.77	.....
Burkes Garden	63	2	35.0	6.43	5.0
Charlottesville	69	16	41.0	3.47	1.5
Clarksville	.....	.....	.....	3.65	1.0
Columbia	73	13	41.3	4.79	0.8
Dale Enterprise	70	2	37.6	2.56	2.0
Danville	.....	.....	.....	6.05	1.8
Dinwiddie	76	10	42.2	3.16	0.5
Elk Knob	67	9	39.4	3.87	4.0
Farmville	73	19	40.0	2.57	T.
Fredericksburg	75	8	41.4	3.02	1.5
Grahams Forge	67	9	38.0	4.54	3.2
Hampton	65	22	43.8	3.18	
Hot Springs	63	8	36.0	4.93	0.5
Ivanhoe	.....	.....	.....	6.32	4.9
Lexington	70	12	39.3	2.81	0.8
Lincoln	71	6	38.7	2.56	1.0
Marion	69	7	39.4	5.62	4.0
Mendota	.....	.....	.....	5.70	2.5
Newport News	75	22	45.5	3.63	1.0
Nokesville (near)	72	11	39.4	2.10	1.0
Petersburg	76	10	41.8	1.78	T.
Quantico	70	15	40.4	3.24	0.5
Radford	.....	.....	.....	3.56	2.0
Randolph	.....	.....	.....	3.41	
Riverton	.....	.....	.....	2.08	1.0
Roanoke	76[e]	18[e]	42.6[e]	3.93	2.0
Rockymount	67	12	42.1	4.23	1.0
Shenandoah	.....	.....	.....	1.72	1.5
Skyland	.....	.....	.....	4.86	3.8
Speers Ferry	.....	.....	.....	6.06	4.0
Spottsville	76	15	44.8	3.79	0.5
Staunton	69	4	39.8	2.98	2.0
Stephens City	74	9	39.2	2.48	2.0
Warsaw	75	7	41.8	3.67	1.5
Williamsburg	72	17	43.8	4.00	0.5
Woodstock	74	8	39.5	2.01	1.5
Washington.					
Aberdeen	57	28	41.2	12.29	9.5
Anacortes	56	29	42.1	2.32	1.5
Ashford	.....	.....	.....	8.16	.....
Baker	58	26	38.6	8.26	5.2

TABLE II.—*Climatological record of cooperative observers*—Continued. *Late reports for December, 1905.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Washington—Cont'd.	°	°	°	*Ins.*	*Ins.*
Bellingham	60	26	42.4	2.80	1.5
Blaine	54	25	40.2	4.71	3.5
Brinnon	53	26	39.8	9.83	8.5
Cedonia	44	6	26.0	2.25	16.5
Centralia	58	28	41.2	6.96	2.5
Cheney	49	3	30.0	1.96	15.0
Clearbrook	54	22	37.8	6.44	4.0
Clearwater	57	29	39.8	18.57	6.0
Cle Elum	51	5	30.4	4.79	43.0
Colville	49	− 2	27.2	2.48	18.9
Conconully	44	− 3	25.0	0.92	8.3
Coupeville	57	28	42.7	1.65	1.8
Crescent	44	1	27.6	2.07	14.0
Cusick	40	0	25.4	3.35	30.0
Danville	45	− 6	26.7	0.87	5.9
Dayton	61	17	37.9	1.02	3.0
Easton	......	......	......	8.48	75.0
East Sound	56	22	40.0	2.85	3.0
Ellensburg	50	− 2	29.2	1.08	......
Ephrata	44	− 4	26.0	0.30	3.0
Fort Simcoe	56[a]	22[a]	38.2[a]	1.61	12.5
Grandmound	58	25	40.3	6.42	1.8
Granite Falls	......	......	......	6.09	......
Hatton	50	9	31.2	0.97	5.0
Ilwaco	60	30	43.9	11.83	T.
Kennewick	58	16	36.0	0.23	1.5
Kiona	56	20	35.6	1.01	4.0
Kosmos	59	28	39.4	5.07	7.0
Lacenter	55	27	40.0	6.13	2.0
Lakeside	43	7	28.7	1.24	11.0
Lester	55	17	34.2	6.25	60.0
Lind	48	7	28.6	1.36	9.5
Loomis	43	2	25.0	1.30	13.0
Merritt	......	......	......	8.41	77.5
Mottinger Ranch	62	19	37.4	0.74	0.2
Mount Pleasant	58	28	41.0	6.54	T.
Moxee	57	− 1	30.5	1.16	5.8
Northport	42	3[a]	26.5	......	14.3
Odessa[1]	45	− 4	29.0	......	......
Olga	54	31	42.2	2.77	1.5
Olympia	56	27	40.6	8.57	3.0
Pinehill	56	18	37.8	2.79	21.0
Pomeroy	56	9	37.0	1.12	1.5
Port Townsend	55	31	42.3	1.66	2.0
Pullman	46	8	32.9	1.80	11.9
Rattlesnake	48	8	29.9	1.81	5.5
Republic	42	− 1	25.4	0.96	6.0
Ritzville	......	......	......	1.16	......
Rock Lake	......	......	......	1.10	3.0
Rosalia	49	6	31.2	1.90	8.3
Sedro	53	25	40.4	3.74	3.0
Snohomish	54	29	41.4	4.10	3.0
Snoqualmie	56	26	39.3	6.74	3.0
Southbend	58	30	43.4	11.61	......
Sunnyside	......	......	......	0.46	1.7
Tekoa	......	......	......	1.47	......
Touchet	59	19	37.6	0.50	1.5
Trinidad	45	2	28.2	0.77	5.5
Twisp	43	− 8	22.0	1.20	14.0
Union	55	29	40.0	14.38	5.0
Vancouver	59	29	41.8	4.90	T.
Vashon	54	30	42.2	7.13	1.0
Wahluke	56	15	33.7	0.75	4.0
Waterville	44	0	22.6	1.25	10.0
Wenatchee (near)	54	8	28.0	1.41	18.0
Wilbur	40	− 5	24.2	1.71	10.0
Zindel	57	18	37.9	0.76	0.7
West Virginia.					
Bancroft	76	4	41.2	3.30	3.0
Bayard	69	2	32.9	3.85	7.7
Beckley	71	1	37.2	4.33	1.0
Bens Run	75	5	38.3	3.42	9.0
Berkley Springs	75[a]	8[a]	37.4[a]	2.15	3.5
Bluefield	65	10	36.2	5.50	......
Buckhannon	74	− 4	37.8	4.25	4.5
Burlington	72	0	36.7	2.27	4.0
Cairo	77	− 2	40.2	4.31	8.0
Central	76	− 3	37.0	3.60	6.5
Charleston	73	10	42.4	3.31	4.0
Creston	75	− 1	38.4	3.75	2.5
Cuba	77	− 1	38.3	2.98	3.0
Durbin[d]	65	5	32.4	......	......
Elkhorn	70	12	39.8	4.88	3.2
Fairmont	76	− 3	40.2	3.87	3.0
Franklin[e]	72	2	38.8	......	......
Glenville	77	− 1	39.9	4.44	8.4
Grafton	75	2	39.0	3.27	4.0
Green Sulphur Springs	73	7	38.2	5.41	......
Harpers Ferry	......	......	......	2.51	1.5
Hinton	69	14	39.7	5.90	1.5
Huntington	75	6	38.5	3.38	3.0
Leonard	63	5	36.6	......	......
Lewisburg	69	10	37.6	5.18	T
Logan	76	11	42.8	3.36	4.0
Lost Creek	77	− 3	40.0	4.36	4.5
Madison	78	6	37.9	4.30	3.0
Martinsburg	70	8	37.2	2.60	2.5
Moorefield	77	− 2	38.4	2.70	4.5
West Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Morgantown	76	6	39.4	3.92	6.0
Moundsville	76	4	38.8	2.54	6.0
New Cumberland	73	8	36.4	1.40	3.5
New Martinsville	79	5	40.2	3.31	6.5
Nuttallburg	58	8	30.4	3.30	4.0
Parsons	75[d]	7[d]	37.2[d]	4.40	7.0
Philippi	77	− 5	38.3	4.17	6.5
Pickens	67	3	35.5	3.53	11.0
Point Pleasant	77	6	40.8	3.72	4.0
Powellton	75	10	41.6	3.86	6.7
Princeton	62	3	33.0	8.70	10.5
Romney	77	6	38.8	2.55	5.0
Rowlesburg	......	......	......	4.64	7.2
Ryan	78	− 1	39.4	2.95	4.0
Southside	76	2	39.4	2.93	12.0
Spencer	70	− 2	36.2	3.06	5.5
Sutton	79	2	39.0	5.10	3.0
Terra Alta	72	4	31.6	3.96	9.0
Uppertract	71	3	37.8	2.36	4.0
Valley Fork	78	− 2	39.7	4.60	3.1
Webster Springs	74	5	40.6	5.70	2.0
Wellsburg	71	7	35.8	2.29	5.0
Weston	......	......	......	4.64	6.6
Wheeling	80	12	48.8	2.10	7.0
Williamson	64	10	38.0	3.71	2.0
Wisconsin.					
Amherst	45	−12	20.4	2.38	20.8
Antigo	45	−10	20.7	1.51	15.1
Appleton	47	− 1	24.6	1.77	17.6
Appleton Marsh	46	−12	20.4	2.32	18.5
Ashland	42	− 2	21.4	1.37	12.0
Barron	50	−20	17.4	3.20	32.0
Beloit	59	0	26.5	2.73	6.2
Berlin	47	− 7	21.0	1.30	13.0
Black River Falls	......	......	......	2.54	24.0
Brodhead	60	− 3	27.2	2.08	7.1
Butternut	50	−22	17.4	3.38	33.8
Chilton	53	1	24.6	3.70	21.7
Chippewa Falls	......	......	......	2.41	23.0
City Point	45	−11	20.6	1.37	17.5
Downing	45	−20	17.2	3.00	30.0
Eau Claire	44	−16	19.4	2.24	22.5
Florence	45	− 4	21.1	2.25	22.5
Fond du Lac	52	− 8	23.9	2.47	11.0
Grand Rapids	47	−17	20.0	2.23	17.0
Grand River Locks	......	......	......	3.11	17.1
Grantsburg	46	−28	15.9	3.05	30.5
Hancock	45	−12	20.0	1.60	12.0
Harvey	57	− 3	24.8	3.56	9.2
Hayward	46	−21	15.6	2.02	20.2
Hillsboro	50	− 12	20.2	2.10	19.0
Koepenick	48	−20	19.7	2.80	28.0
Lancaster	51	− 8	23.4	......	......
Manitowoc	55	4	27.4	3.41	13.8
Mauston	44	− 8	22.2	2.00	14.5
Meadow Valley	46	−15	19.0	1.94	22.0
Medford	46	−15	19.5	1.80	18.0
Menasha	......	......	......	1.45	16.5
Merrill	55	−22	18.8	1.38	20.0
Minocqua	44	−19	18.7	1.70	17.0
Mount Horeb	50	− 6	23.8	3.15	16.0
Neillsville	44	−16	19.3	2.00	20.0
New London	47	− 5	23.4	2.73	24.0
New Richmond	45	−11	18.8	2.20	22.0
Oconto	46	− 3	25.2	3.22	19.0
Osceola	45	−28	17.0	4.50	19.0
Oshkosh	47	− 3	24.2	2.03	10.0
Pine River	49	−10	22.4	2.33	18.0
Portage	52	− 6	23.6	2.14	13.0
Port Washington	58	4	26.3	3.90	14.0
Prairie du Chien	49	− 5	23.7	2.28	11.5
Prentice	46	−24	17.6	4.35	45.8
Racine	60	6	30.0	2.46	......
Sheboygan	56	5	28.6	3.67	18.7
Spooner	43	−24	16.7	1.45	20.0
Stanley	43	−20	17.9	2.32	18.5
Sturgeon Bay Canal	46	0	26.3	3.78	14.4
Valley Junction	44	−14	20.7	2.45	15.2
Viroqua	43	−11	21.7	2.46	19.0
Watertown	57	− 5	24.3	2.78	12.0
Waukesha	......	......	......	3.54	6.5
Waupaca	44	−12	21.4	2.59	18.5
Wausau	46	−13	20.4	1.56	13.0
Whitehall	45	−27	18.4	2.26	22.6
Wyoming.					
Afton	43	−21	16.0	1.72	16.5
Alcova[k]	52	− 4	30.4	......	......
Barnum	......	......	......	0.61	6.1
Barrett Creek Cabin	63	−18	23.2	3.00	30.0
Basin	43	−30	6.9	0.17	1.7
Bedford	45	−18	17.6	2.30	23.0
Border	43	−31	10.8	1.84	......
Buffalo	59	−12	26.4	0.22	2.2
Cambria	60	0	28.2	0.85	8.5
Chugwater	60	−10	31.2	0.55	5.5
Clark	......	......	......	0.10	2.3
Cody	59	− 4	32.3	0.20	2.0
Daniel	40	−31	16.4	2.23	22.2
Wyoming—Cont'd.	°	°	°	*Ins.*	*Ins.*
Elk Mountain	......	......	......	1.62	21.5
Embar	53	−14	23.8	1.10	11.0
Evanston	41	−15	19.4	1.37	8.5
Experiment Farm	......	......	......	0.15	1.5
Fayette	46	−29	15.0	......	......
Fontenelle	38	−27	11.8	1.25	12.5
Fort Laramie	63	− 9	25.8	T.	T.
Fort Washakie	47	−20	20.9	1.12	7.7
Gillette	54	−11	27.5	0.60	6.0
Granite Canyon	57	2	28.7	0.30	3.0
Granite Springs	......	......	......	0.16	1.6
Green River	43	−21	18.4	1.01	14.0
Griggs	54	−23	28.0	0.33	3.3
Hatton	......	......	......	0.95	9.5
Hyattville	60	−10	26.4	0.40	4.0
Iron Mountain	53	− 7	26.6	0.26	......
Jackson	40	−29	13.4	3.13	24.2
Kirtley	54	−10	26.0	0.64	7.8
Laramie	52	−11	24.2	0.58	7.1
Leo	42	−17	22.5	0.51	5.0
Little Medicine	46	−20	17.5	0.24	3.0
Lolabama Ranch	......	......	......	0.47	......
Moore	54	1	29.7	0.17	3.0
Pathfinder	48	−20	23.4	......	......
Phillips	64	−10	32.4	0.30	3.0
Pine Bluff	68	0	31.0	T.	T.
Pinedale	40	−25	13.8	1.00	10.0
Rambler	55	−11	15.8	2.09	......
Rawlins	41	− 7	22.9	0.42	......
Sheridan	59	− 15	25.8	1.00	10.0
South Pass City	48	−21	15.8	4.30	43.0
Thayne	41	−22	16.0	2.67	20.0
Thermopolis	44[f]	−18[f]	17.6[f]	1.05	10.5
Wells	42	−22	14.7	3.60	34.0
Wheatland	65	1	35.0	T.	T.
Wolf	64	− 3	34.2	1.10	11.0
Yellowstone Pk. (Fount)[e]	48	−22	17.2	......	......
Yellowstone Pk. (G. Can.)	40	−20	14.6	......	......
Yellowstone Pk. (Lake)	38	−23	14.2	4.99	56.2
Yellowstone Pk. (Norris)	35	−30	11.6	4.40	......
Yellowstone Pk. (River.)	40	−22	17.6	1.61	26.0
Yellowstone Pk (Snake R)	40	−25	18.6	3.70	37.0
Yellowstone Pk. (Soda B.)	44	−22	17.2	1.44	14.4
Yellowstone Pk. (Thumb)	36	−28	12.4	......	......
Yellowstone Pk. (Up. B.)	45	−22	17.4	4.88	33.0
Porto Rico.					
Adjuntas	93	46	68.7	1.07	
Aqua Buenos	......	......	......	2.32	
Aguirre	99	60	75.5	1.97	
Aibonita	80	50	66.8	5.50	
Arecibo	90	52	71.4	1.36	
Barros	81	51	67.5	1.75	
Bayamon	87	55	72.0	1.42	
Caguas	87	53	70.8	1.44	
Canovanas	87	65	75.4	2.25	
Cayey	85	70	77.3	2.02	
Cidra	86	53	70.0	2.23	
Coloso	91	67	78.8	0.05	
Carozal	92	54	76.8	1.25	
Fajardo	89	61	77.4	1.30	
Guanica	91	54	73.2	0.33	
Hacienda Josefa	......	......	......	1.59	
Humacao	84	59	76.5	3.07	
Isabela	87	66	76.7	1.13	
Isolina	87	56	70.8	1.56	
Juana Diaz	92	61	77.8	0.76	
Lares	90	53	71.3	0.41	
Las Cruces	85	56	68.1	3.02	
Las Marias	86	58	72.4	0.15	
Manati	90	57	73.3	1.36	
Maunabo	90	62	77.5	3.23	
Mayaguez	90	57	74.0	0.91	
Morovis	92	54	72.6	2.18	
Ponce	86	59	74.5	1.05	
Rio Blanco	87	57	74.4	3.59	
Rio Piedras	......	......	......	1.59	
San German	90	59	75.4	1.24	
San Lorenzo	87	54	72.6	2.60	
San Salvador	84	54	70.1	0.83	
Santa Isabel	87	56	73.4	0.76	
Vieques	92	65	77.5	2.17	
Yauco	88	52	72.6	0.36	
New Brunswick.					
St. John	46	− 1	25.0	5.49	2.4
West Indies.					
Basseterre, St. Kitts	84	67	76.2	2.25	

Late reports for December, 1905.

Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alaska.	°	°	°	*Ins.*	*Ins.*
Chestochena	22[c]	−30[c]	0.2[c]	0.75	9.0
Copper Center	36	−33	−2.1	0.97	15.9
Eagle	17	−50	−14.8	0.20	2.0
Fairbanks	33	−55	−13.4	0.60	6.0
Fort Egbert	......	......	......	0.68	10.0
Fort Gibbon	16	−62	−16.6	0.70	7.0

TABLE II.—*Climatological record of cooperative observers. Late reports for December, 1905*— Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alaska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fort Liscum	39	4	24.4	7.75	62.7
Juneau	46	20	36.8	10.32	......
Ketchemstock	14	—51	-11.0	0.20	2.0
Rampart	13	-56	-16.9	0.33	3.2
Sunrise	44	—14	20.0	8.48	33.7
Teikhill	37	—25	5.4	2.34	22.5
Wood Island	61	12	32.2	2.42	6.2
Arizona.					
Showlow	.....	.....	.....	1.49	16.0
Arkansas.					
Bee Branch	70[h]	15	37.9[d]	4.70	5.0
Pond	58	8[g]	36.0[d]	2.35	T.
California.					
Summit	39	10	25.2	3.70	37.0
Towle	71	15	39.0	5.62	32.0
Willows	68	35	50.8	0.95	0.0
Colorado.					
Lake Moraine	47	—19	16.8	0.05	1.0
Florida.					
Fort Pierce	84	46	65.8	3.41	
Kansas.	°	°	°	*Ins.*	*Ins.*
Coffeyville	62	15	37.0	......	
Louisiana.					
Caspiana	64[b]	25[e]	43.4[e]	8.49	1.0
Massachusetts.					
Lowell	57	5	31.6	3.86	.....
New Jersey.					
Tuckerton	59	12	35.2	5.30	3.0
New Mexico.					
Carlsbad	64	11	38.0	0.64	1.0
Mountainair	45	—13	23.8	3.04	30.4
Springer	.....	.....	.....	0.25	2.5
North Carolina.					
Brewers	65	10	38.7	7.07	4.0
Texas.					
Rockport	68	46	57.0	4.30	.....
West Virginia.					
Wheeling	62	18	40.6	1.25	0.2
Porto Rico.					
Aqua Buenos	.....	.....	.....	13.06	•
Corozal	91	59	77.6	2.34	
Isabela	87	68	77.4	1.05	

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. + 2.
[3] Mean of 7 a. m. + 7 p. m. + 2.
[4] Mean of 6 a. m. + 6 p. m. + 2.
[5] Mean of 7 a. m. + 2 p. m. + 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "n" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

December, 1905, New Mexico, Laguna, make snowfall 28.0 instead of 29.0; Tucumcari, make mean temperature 34.2[f] instead of 34.7[f]; Porto Rico, make Isabela read Santa Isabela.

August, 1905, Arkansas, Hardy, make mean temperature 77.6 instead of 75.6.

NOTE.—The following change has been made in names of stations: Arizona, Tonto changed to Cline.

TABLE III.—*Wind resultants, from observations at 8 a. m. and 8 p. m., daily, during the month of January, 1906.*

Stations.	Component direction from— N.	S.	E.	W.	Resultant. Direction from—	Duration.
	Hours.	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
New England.						
Eastport, Me	20	19	6	30	n. 88 w.	24
Portland, Me	24	19	5	27	n. 77 w.	23
Concord, N. H. †	12	7	5	14	n. 61 w.	10
Northfield, Vt	19	34	3	17	s. 43 w.	20
Boston, Mass	21	23	7	28	s. 85 w.	21
Nantucket, Mass	21	20	14	22	n. 83 w.	8
Block Island, R. I	22	21	10	24	n. 86 w.	14
Narragansett, R. I.*	......	......	......	......	......	......
Providence, R. I	17	17	13	28	w.	15
Hartford, Conn	25	23	7	21	n. 82 w.	14
New Haven, Conn	27	18	16	16	n.	9
Middle Atlantic States.						
Albany, N. Y	21	23	12	20	s. 76 w.	8
Binghamton, N. Y. †	10	5	13	9	n. 39 e.	6
New York, N. Y	20	17	16	23	n. 67 w.	8
Harrisburg, Pa	17	17	24	20	e.	4
Philadelphia, Pa	22	18	13	22	n. 66 w.	10
Scranton, Pa	21	21	14	23	w.	9
Atlantic City, N. J	21	19	12	27	n. 82 w.	15
Cape May, N. J	24	23	11	19	n. 83 w.	8
Baltimore, Md	21	19	11	23	n. 81 w.	12
Washington, D. C	21	26	10	17	s. 54 w.	9
Cape Henry, Va.*	......	......	......	......	......	......
Lynchburg, Va	19	21	17	23	s. 72 w.	6
Mount Weather, Va	23	20	9	27	n. 81 w.	18
Norfolk, Va	17	26	15	15	s.	9
Richmond, Va	20	28	10	12	s. 14 w.	8
Wytheville, Va	15	8	18	31	n. 62 w.	15
South Atlantic States.						
Asheville, N. C	23	22	18	17	n. 45 e.	1
Charlotte, N. C	19	18	22	16	n. 80 e.	6
Hatteras, N. C	26	16	16	15	n. 6 e.	10
Raleigh, N. C	21	21	13	19	w.	6
Wilmington, N. C	24	15	20	19	n. 6 e.	9
Charleston, S. C	23	12	19	19	n.	11
Columbia, S. C	21	16	20	19	n. 11 e.	5
Augusta, Ga	19	15	18	23	n. 51 w.	6
Savannah, Ga	21	10	17	22	n. 24 w.	12
Jacksonville, Fla	25	10	15	23	n. 28 w.	17
Florida Peninsula.						
Jupiter, Fla	27	15	18	19	n. 5 w.	12
Key West, Fla	36	6	30	5	n. 40 e.	39
Sand Key, Fla. †	......	......	......	......	......	......
Tampa, Fla	32	4	23	20	n. 6 e.	28
Eastern Gulf States.						
Atlanta, Ga	19	14	21	24	n. 31 w.	6
Macon, Ga. †	14	7	7	10	n. 23 w.	8
Thomasville, Ga †	10	6	9	11	n. 27 w.	4
Pensacola, Fla. †	14	7	9	9	n.	7
Anniston, Ala	19	24	16	15	s. 11 e.	5
Birmingham, Ala. †	9	8	12	7	n. 79 e.	5
Mobile, Ala	26	19	15	17	n. 16 w.	7
Montgomery, Ala	19	19	21	20	e.	1
Meridian, Miss. †	13	8	5	12	n. 54 w.	9
Vicksburg, Miss	22	21	19	13	n. 80 e.	6
New Orleans, La	29	10	17	17	n.	19
Western Gulf States.						
Shreveport, La	16	21	13	22	s. 61 w.	10
Fort Smith, Ark	11	14	29	19	s. 73 e.	10
Little Rock, Ark	19	19	18	23	w.	5
Corpus Christi, Tex	18	25	19	13	s. 41 e.	9
Fort Worth, Tex	17	26	12	19	s. 38 w.	11
Galveston, Tex	21	21	20	14	e.	6
Palestine, Tex	20	23	13	17	s. 53 w.	5
San Antonio, Tex	22	20	20	16	n. 63 e.	4
Taylor, Tex. †	8	12	3	11	s. 63 w.	9
Ohio Valley and Tennessee.						
Chattanooga, Tenn	22	18	18	19	n. 14 w.	4
Knoxville, Tenn	20	18	17	21	n. 63 w.	4
Memphis, Tenn	22	20	16	13	n. 56 e.	4
Nashville, Tenn	20	20	10	27	w.	17
Lexington, Ky. †	6	14	9	9	s.	8
Louisville, Ky	14	26	14	23	s. 37 w.	15
Evansville, Ind. †	9	11	8	9	s. 27 w.	2
Indianapolis, Ind	14	29	13	19	s. 22 w.	16
Cincinnati, Ohio	13	24	22	20	s. 10 e.	11
Columbus, Ohio	10	31	16	21	s. 13 w.	22
Pittsburg, Pa	18	20	13	24	s. 80 w.	11
Parkersburg, W. Va	16	23	11	24	s. 62 w.	15
Elkins, W. Va	15	16	9	29	s. 87 w.	20
Lower Lake Region.						
Buffalo, N. Y	9	26	12	25	s. 38 w.	22
Oswego, N. Y	13	32	14	16	s. 6 w.	19
Rochester, N. Y	5	26	10	31	s. 45 w.	30
Syracuse, N. Y	9	27	15	19	s. 13 w.	18
Erie, Pa	8	26	9	26	s. 43 w.	25
Cleveland, Ohio	11	33	18	16	s. 5 e.	22
Sandusky, Ohio †	2	13	6	17	s. 45 w.	16
Toledo, Ohio	6	26	16	26	s. 27 w.	22
Detroit, Mich	10	25	13	27	s. 43 w.	20
Upper Lake Region.						
Alpena, Mich	17	23	8	32	s. 76 w.	25
Escanaba, Mich	21	17	9	27	n. 77 w.	18
Grand Haven, Mich	13	23	14	25	s. 48 w.	15
Grand Rapids, Mich	14	24	14	24	s. 45 w.	14
Houghton, Mich. †	8	4	14	10	n. 45 e.	6
Marquette, Mich	13	20	9	32	s. 73 w.	24
Port Huron, Mich	9	29	9	24	s. 37 w.	25
Sault Ste. Marie, Mich	18	16	21	21	n.	2
Chicago, Ill	13	24	9	31	s. 64 w.	25
Milwaukee, Wis	13	24	8	29	s. 62 w.	24
Green Bay, Wis	14	26	13	27	s. 49 w.	18
Duluth, Minn	19	10	13	33	n. 66 w.	22
North Dakota.						
Moorhead, Minn	24	24	14	18	w.	4
Bismarck, N. Dak	23	12	18	25	n. 32 w.	13
Devils Lake, N. Dak	14	21	15	26	s. 58 w.	13
Williston, N. Dak	19	20	13	26	s. 86 w.	13
Upper Mississippi Valley.						
Minneapolis, Minn.*	6	9	7	16	s. 72 w.	10
St. Paul, Minn	18	17	15	25	n. 84 w.	10
La Crosse, Wis. †	12	12	5	5	......	......
Madison, Wis	16	24	12	27	s. 62 w.	17
Charles City, Iowa	18	17	17	22	n. 79 w.	5
Davenport, Iowa	20	17	12	27	n. 79 w.	15
Des Moines, Iowa	19	21	12	27	s. 82 w.	15
Dubuque, Iowa	11	24	13	16	s. 13 w.	13
Keokuk, Iowa	12	26	12	30	s. 52 w.	23
Cairo, Ill	17	26	14	21	s. 38 w.	11
La Salle, Ill. †	6	10	10	11	s. 14 w.	4
Peoria, Ill. †	4	17	8	6	s. 9 e.	13
Springfield, Ill	10	30	12	23	s. 29 w.	23
Hannibal, Mo. †	7	13	5	14	s. 56 w.	11
St. Louis, Mo	16	23	13	24	s. 58 w.	13
Missouri Valley.						
Columbia, Mo.*	7	11	6	12	s. 56 w.	7
Kansas City, Mo	13	28	13	21	s. 28 w.	17
Springfield, Mo	20	25	14	18	s. 39 w.	6
Iola, Kans. †	9	13	3	13	s. 68 w.	11
Topeka, Kans.*	10	12	4	10	s. 72 w.	6
Lincoln, Nebr	20	26	10	17	s. 49 w.	9
Omaha, Nebr	25	23	8	19	n. 80 w.	11
Valentine, Nebr	22	9	8	35	n. 64 w.	30
Sioux City, Iowa †	12	10	7	11	n. 63 w.	4
Pierre, S. Dak	21	17	21	24	n. 37 w.	5
Huron, S. Dak	26	17	10	23	n. 55 w.	16
Yankton, S. Dak. †	10	6	6	15	n. 66 w.	10
Northern Slope.						
Havre, Mont	18	8	18	31	n. 52 w.	16
Miles City, Mont	14	28	13	18	s. 20 w.	15
Helena, Mont	9	14	1	48	s. 84 w.	47
Kalispell, Mont	19	13	2	42	n. 81 w.	40
Rapid City, S. Dak	26	7	8	32	n. 51 w.	31
Cheyenne, Wyo	29	11	3	36	n. 61 w.	38
Lander, Wyo	17	23	21	14	s. 49 e.	9
Yellowstone Park, Wyo	2	48	3	21	s. 21 w.	49
North Platte, Nebr	19	14	13	28	n. 72 w.	16
Middle Slope.						
Denver, Colo	17	28	10	15	s. 24 w.	12
Pueblo, Colo	20	15	19	25	n. 50 w.	8
Concordia, Kans	18	28	9	20	s. 48 w.	15
Dodge, Kans	20	21	14	23	s. 84 w.	9
Wichita, Kans	23	25	9	17	s. 76 w.	8
Oklahoma, Okla	21	25	9	19	s. 68 w.	11
Southern Slope.						
Abilene, Tex	19	31	2	19	s. 55 w.	21
Amarillo, Tex	17	26	5	32	s. 72 w.	28
Del Rio, Tex †	10	5	8	14	n. 50 w.	8
Roswell, N. Mex	25	17	12	19	n. 41 w.	11
Southern Plateau.						
El Paso, Tex	21	3	20	30	n. 29 w.	21
Santa Fe, N. Mex	33	12	31	8	n. 48 e.	31
Flagstaff Ariz	18	13	22	21	n. 11 e.	5
Phoenix, Ariz	9	15	33	17	s. 69 e.	17
Yuma, Ariz	37	11	19	5	n. 28 e.	3
Independence, Cal	29	16	4	31	n. 64 w.	30
Middle Plateau.						
Reno, Nev	12	17	18	30	s. 67 w.	13
Winnemucca, Nev	22	19	24	17	n. 67 e.	8
Modena, Utah	9	12	19	32	s. 77 w.	13
Salt Lake City, Utah	13	29	21	15	s. 21 e.	17
Durango, Colo	26	9	2	35	n. 62 w.	37
Grand Junction, Colo	26	12	10	32	n. 58 w.	26
Northern Plateau.						
Baker City, Oreg	9	40	12	12	s.	31
Boise, Idaho	16	22	22	18	s. 34 e.	7
Lewiston, Idaho †	6	3	21	3	n. 81 e.	18
Pocatello, Idaho	3	16	36	16	s. 57 e.	24
Spokane, Wash	16	24	27	9	s. 66 e.	20
Walla Walla, Wash	7	41	8	17	s. 15 w.	35
North Pacific Coast Region.						
North Head, Wash	10	26	28	9	s. 50 e.	25
Port Crescent, Wash.*	3	15	17	4	s. 47 e.	18
Seattle, Wash	11	34	26	5	s. 42 e.	31
Tacoma, Wash	12	34	6	19	s. 30 w.	26
Tatoosh Island, Wash	6	25	25	12	s. 34 e.	23
Portland, Oreg	14	21	19	25	s. 41 w.	9
Roseburg, Oreg	12	31	13	18	s. 15 w.	20
Middle Pacific Coast Region.						
Eureka, Cal	12	29	18	13	s. 16 e.	18
Mount Tamalpais, Cal	26	17	18	13	n. 29 e.	10
Red Bluff, Cal	40	14	6	13	n. 15 w.	27
Sacramento, Cal	18	21	25	9	s. 79 e.	16
San Francisco, Cal	26	14	11	22	n. 43 w.	16
Point Reys Light, Cal	......	......	......	......	......	......
San Jose, Cal. †	12	6	4	17	n. 65 w.	14
South Pacific Coast Region.						
Fresno, Cal	19	18	22	13	n. 84 e.	9
Los Angeles, Cal	20	12	21	25	n. 27 w.	9
San Diego, Cal	34	4	19	23	n. 8 w.	30
San Luis Obispo, Cal	31	14	11	17	n. 19 w.	18
West Indies						
Grand Turk, W. I. †	4	12	23	0	s. 71 e.	24
Hamilton, Bermuda	21	20	17	16	n. 45 e.	1
San Juan, Porto Rico	4	18	45	4	s. 71 e.	43

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during January, 1906, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y	3-4			0.38														*			
Alpena, Mich	21-23			1.14														*			
Amarillo, Tex	1-2			0.23														*			
Asheville, N. C	21-22			2.86														0.64			
Atlanta, Ga	2-3			2.11														0.44			
Atlantic City, N. J	23-24			0.29														0.16			
Augusta, Ga	22			0.58														0.49			
Baltimore, Md	3-4			1.51														0.24			
Binghamton, N. Y	23			0.42														0.14			
Birmingham, Ala	22	7:14 a. m.	10:50 a. m.	0.72	8:25 a. m.	8:50 a. m.	0.03	0.18	0.28	0.31	0.37	0.45	0.54								
Bismarck, N. Dak	20			0.42														*			
Block Island, R. I	15-16			0.80														0.37			
Boise, Idaho	23			0.33														0.12			
Boston, Mass	16			1.05														0.31			
Buffalo, N. Y	3			0.42														*			
Cairo, Ill	2-3			2.65														0.64			
Charles City, Iowa	2-3			1.76														*			
Charleston, S. C	25-26			1.57														0.23			
Charlotte, N. C	3			1.93														0.56			
Chattanooga, Tenn	2-3			1.29														0.32			
Cheyenne, Wyo	14			0.07														*			
Chicago, Ill	21-22			0.88														*			
Cincinnati, Ohio	21-22			1.00														0.48			
Cleveland, Ohio	15-16			0.38														0.12			
Columbia, Mo	2-3			2.20														0.38			
Columbia, S. C	3-4			0.98														0.34			
Columbus, Ohio	2-3			1.06														*			
Concord, N. H	3-4			0.94														*			
Corpus Christi, Tex	8			0.36														0.27			
Davenport, Iowa	2-4			1.04														*			
Denver, Colo	7			0.09														*			
Des Moines, Iowa	2-3			1.46														*			
Detroit, Mich	3			0.44														0.12			
Dodge, Kans	2			0.28														*			
Dubuque, Iowa	2-4			1.35														*			
Duluth, Minn	2-4			0.84														*			
Eastport, Me	16			1.29														0.22			
Elkins, W. Va	22			1.43														0.58			
Erie, Pa	22-23			0.28														*			
Escanaba, Mich	3-4			0.99														*			
Evansville, Ind	2-3			2.19														0.49			
Fort Smith, Ark	20-21	8:45 p. m.	5:35 a. m.	1.98	10:37 p. m.	11:37 p. m.	0.15	0.15	0.23	0.28	0.37	0.41	0.46	1.49	0.55	0.73	0.81	0.93			
Fort Worth, Tex	2-3			0.50														0.14			
Galveston, Tex	20-21			0.40														0.32			
Grand Rapids, Mich	21-22			1.70														0.21			
Green Bay, Wis	15-16			0.86														*			
Hannibal, Mo	2-3			1.30														0.25			
Harrisburg, Pa	3-4			0.72														0.14			
Hartford, Conn	3-4			1.06														*			
Hatteras, N. C	12			0.52									0.47								
Huron, S. Dak	20			0.16														*			
Indianapolis, Ind	2-3			1.17														*			
Iola, Kans	2-3			0.86														*			
Jacksonville, Fla	11-12			1.14														0.45			
Jupiter, Fla	23			0.92														0.46			
Kansas City, Mo	2-3			0.95														*			
Key West, Fla	5	6:50 a. m.	2:45 p. m.	1.91	8:41 a. m.	9:16 a. m.	0.49	0.07	0.18	0.26	0.34	0.43	0.63	0.68							
Knoxville, Tenn	15			0.35														0.31			
La Crosse, Wis	2-3			1.07														*			
La Salle, Ill	21-23			1.27														0.13			
Lexington, Ky	2-3			0.72														*			
Lincoln, Nebr	1-2			0.22														*			
Little Rock, Ark	2-3			1.65														0.74			
Los Angeles, Cal	18-19			2.21														0.37			
Louisville, Ky	2-3			1.67														0.29			
Lynchburg, Va	3-4			2.29														0.42			
Macon, Ga	22	D. N.	3:30 p. m.	2.34	12:33 p. m.	12:45 p. m.	1.14	0.40	0.64	0.70											
Madison, Wis	15			1.00														0.19			
Memphis, Tenn	21-22	10:55 a. m.	D. N.	3.58	11:15 a. m.	11:43 a. m.	0.01	0.16	0.38	0.45	0.48	0.63	0.69								
					3:34 p. m.	4:14 p. m.	*1.09	0.13	0.28	0.37	0.42	0.57	0.63	0.68	0.78						
Meridian, Miss	21-22	4:49 p. m.	6:15 a. m.	1.61	3:06 p. m.	3:26 a. m.	0.88	0.11	0.31	0.56	0.67										
Milwaukee, Wis	15-16			0.98														0.08			
Minneapolis, Minn	2-3			0.96														*			
Montgomery, Ala	3	7:15 a. m.	11:55 a. m.	1.16	9:29 a. m.	9:40 a. m.	0.28	0.17	0.53												
Do	21-22	8:15 p. m.	12:10 p. m.	1.54	5:39 a. m.	7:00 a. m.	0.13	0.28	0.33	0.35	0.37	0.39	0.41	0.46	0.56	0.64	0.87	0.94	1.27		
Mount Weather, Va	3-4			1.23														*			
Nantucket, Mass	16			1.70														0.49			
Nashville, Tenn	21-22			1.32														0.26			
New Haven, Conn	3-4			1.22														0.33			
New Orleans, La	21			0.71														0.56			
New York, N. Y	3-4			1.63														0.43			
Norfolk, Va	3-4			0.93														0.27			
Northfield, Vt	3-4			0.60														*			
North Head, Wash	11-12			0.90														*			
Oklahoma, Okla	1-2			0.81														0.12			
Omaha, Nebr	15			0.24														0.11			
Palestine, Tex	2-3			0.89					0.43												
Parkersburg, W. Va	2-3			1.13														0.18			
Pensacola, Fla	3			0.87							0.40										
Peoria, Ill	21-22			1.08														*			
Philadelphia, Pa	3-4			1.60														0.48			
Pittsburg, Pa	22-23			0.43														0.14			
Portland, Me	16			1.44														0.40			
Portland, Oreg	16-17			1.08														0.21			
Pueblo, Colo	1-2			0.29														*			
Raleigh, N. C	25-26			1.47														*			
Richmond, Va	3			1.05														0.30			
Rochester, N. Y	3-4			0.49														*			
Sacramento, Cal	18-19			1.11														0.26			
St. Louis, Mo	21-22			2.32														0.30			

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
St. Paul, Minn	2-4			0.90														*			
Salt Lake City, Utah	19-20			0.64														*			
San Antonio, Tex	1-2			0.08														0.04			
San Diego, Cal	18-19			0.74														0.25			
Sandusky, Ohio	3			0.52														*			
San Francisco, Cal	12			1.00														0.19			
Savannah, Ga	22			0.69														0.40			
Scranton, Pa	23			0.49														0.18			
Seattle, Wash	8-9			0.28																	
Shreveport, La	21	D. N.	11:10 a. m.	1.35	4:35 a. m.	5:02 a. m.	0.02	0.07	0.22	0.45	0.60	0.69	0.71								
Spokane, Wash	11-12			0.67														*			
Springfield, Ill	21-22			2.26														*			
Springfield, Mo	20-22			2.28														*			
Syracuse, N. Y	3			0.66														*			
Tampa, Fla	22-23	4:00 p. m.	7:15 a. m.	1.42	7:46 p. m.	8:46 p. m.	0.34	0.13	0.17	0.23	0.33	0.43	0.52	0.59	0.62	0.67	0.72	0.84			
Taylor, Tex.	21			0.30														0.22			
Toledo, Ohio	2-3			0.37														*			
Topeka, Kans	2			0.36														*			
Valentine, Nebr	19-20			0.21														*			
Vicksburg, Miss	21	12:03 p. m.	5:10 p. m.	1.02	3:07 p.m.	3:27 p. m.	0.35	0.26	0.38	0.45	0.53										
Washington, D. C	2-4			1.38														0.19			
Wichita, Kans	12			0.12														0.07			
Williston, N. Dak.	13-14			0.73														*			
Wilmington, N. C.	23			0.52														0.28			
Wytheville, Va.	22			1.60														0.37			
Yankton, S. Dak	2-3			0.23														*			
San Juan, Porto Rico	2			0.23														0.15			

* Self-register not working

TABLE V.—*Data furnished by the Canadian Meteorological Service, January, 1906.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Temperature. Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Precipitation. Total.	Departure from normal.	Total snowfall.	Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Temperature. Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Precipitation. Total.	Departure from normal.	Total snowfall.
	Ins.	Ins.	Ins.	°	°	°	°	Ins.	Ins.	Ins.		Ins.	Ins.	Ins.	°	°	°	°	Ins.	Ins.	Ins.
St. Johns, N. F	29.79	29.93	+.07	26.8	+ 3.0	34.2	19.5	4.07	−1.84	T.	Parry Sound, Ont	29.29	30.02	+.01	23.4	+ 9.6	32.0	14.7	5.14	+1.06	17.0
Sydney, C. B. I.	30.01	30.05	+.12	27.6	+ 7.1	34.6	20.6	4.45	−0.65	10.5	Port Arthur, Ont.	29.25	29.98	−.09	16.4	+13.3	27.0	5.7	0.45	−0.37	4.5
Halifax, N. S.	29.98	30.09	+.12	28.0	+ 6.2	36.0	19.9	4.65	−1.12	12.2	Winnipeg, Man	29.14	30.02	−.09	6.8	+13.6	17.0	− 3.3	1.33	+0.45	13.3
Grand Manan, N. B	30.00	30.05	+.06	29.2	+ 5.8	37.6	20.7	3.53	−1.38	2.6	Minnedosa, Man	28.11	30.02	−.08	9.0	+16.2	19.5	- 1.4	0.88	+0.08	8.8
Yarmouth, N. S	30.02	30.09	+.09	30.4	+ 4.1	37.4	23.3	3.41	−2.00	15.6	Qu'Appelle, Assin.	27.63	29.99	−.09	9.0	+12.8	17.7	0.4	1.19	+0.69	11.9
Charlottetown, P. E. I	29.98	30.02	+.06	23.9	+ 6.9	31.3	16.5	2.20	−1.76	11.0	Medicine Hat, Assin	27.63	30.00	−.07	18.4	+12.9	28.0	8.9	0.50	−0.07	5.0
Chatham, N. B	29.99	30.02	+.05	19.6	+ 9.8	29.7	9.6	2.77	−0.82	9.8	Swift Current, Assin	27.36	30.06	−.03	14.4	+11.3	24.4	4.5	0.72	+0.08	7.2
Father Point, Que.	29.99	30.02	+.04	16.8	+ 8.8	24.9	8.6	1.76	−1.09	16.6	Calgary, Alberta	26.29	29.98	−.05	16.0	+ 7.6	26.2	5.8	0.04	− 0.49	0.4
Quebec, Que	29.71	30.05	+.03	16.2	+ 7.1	24.4	7.9	2.43	−1.58	18.1	Banff, Alberta	25.23	30.01	+.01	19.0	+ 6.9	28.3	9.7	0.77	−0.42	7.7
Montreal, Que	29.84	30.06	+.02	21.1	+ 9.4	28.5	13.7	2.79	−0.94	14.9	Edmonton, Alberta										
Rockliffe, Ont.	29.49	30.04	+.02	13.6	+ 7.2	25.0	2.2	1.23	−1.09	11.4	Prince Albert, Sask	28.33	29.97	−.12	4.3	+12.7	14.8	− 6.2	1.50	+0.53	15.0
Ottawa, Ont	29.69	30.03	.00	20.8	+11.2	29.3	12.3	1.25	−1.74	10.1	Battleford, Sask	28.22	30.06	−.02	6.4	+12.3	16.0	− 3.1	0.12	−0.28	1.2
Kingston, Ont.	29.75	30.08	+.03	26.6	+ 9.5	34.2	19.0	2.08	−1.37	8.2	Kamloops, B. C.	28.72	29.97	+.01	28.0	+ 5.0	34.0	21.9	0.72	−0.10	7.2
Toronto, Ont	29.65	30.05	.00	31.0	+ 9.6	37.0	24.9	1.75	−1.17	4.3	Victoria, B. C.	29.90	30.00	+.03	41.6	+ 3.1	45.1	38.0	2.56	−2.83	2.9
White River, Ont	28.59	29.97	−.04	10.1	+14.5	22.7	− 2.5	1.41	−0.28	14.0	Barkerville, B. C.	25.49	29.89	.00	19.6	+ 1.8	26.8	12.3	3.40	+0.80	30.0
Port Stanley, Ont	29.39	30.05	−.02	30.0	+ 7.8	35.8	24.1	2.44	−0.55	10.0	Hamilton, Bermuda	30.02	30.19	+.06	64.4	+ 2.4	68.7	60.1	6.70	+1.76	
Saugeen, Ont	29.29	30.02	−.01	29.1	+ 8.7	36.3	21.9	3.71	−0.34	19.6	Dawson, Yukon										

TABLE VI.—*Heights of rivers referred to zeros of gages, January, 1906.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
	Miles.	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Milk River.								
Havre, Mont. (31)	237	9	......	......	......	......	......	......
James River.								
Huron, S. Dak. (31)	139	9	......	......	......	......	......	......
Big Blue River.								
Beatrice, Nebr (4)	92	14	2.4	7, 18-20, 26	2.1	1-5	2.2	0.3
Blue Rapids, Kans (5)	47	14	5.8	7, 8	4.6	1, 2	5.1	1.2
Republican River.								
Clay Center, Kans	42	18	7.2	30, 31	5.9	24	6.5	1.3
Solomon River.								
Beloit, Kans	75	16	1.7	19	0.5	4-7, 9, 10, 12-14, 17, 22-25, 27-30	0.9	1.2
Smoky Hill River.								
Lindsborg, Kans	109	20	2.6	1	0.9	11	1.6	1.7
Abilene, Kans	45	22	2.5	23	1.0	16, 27, 29-31	1.4	1.5
Kansas River.								
Manhattan, Kans	116	18	3.4	27-31	1.9	23	2.9	1.5
Topeka, Kans (2)	87	21	7.0	18-21, 24, 26, 27	6.6	3-11	6.8	0.4
Missouri River.								
Bismarck, N. Dak	1,309	14	1.4	1, 2, 5	0.3	19-21	0.7	1.1
Pierre, S. Dak. (31)	1,114	14	......	......	......	......	......	......
Sioux City, Iowa	784	19	7.2	4	4.6	3	5.8	2.6
Blair, Nebr	705	15	6.7	23	4.0	7.8	5.3	2.7
Omaha, Nebr	669	18	4.4	25	3.2	14-16	3.6	1.2
St. Joseph, Mo	481	10	1.7	28	— 2.6	10	—0.3	4.3
Kansas City, Mo	388	21	7.3	29	3.7	12	5.8	3.6
Glasgow, Mo	231	18	7.3	24	3.5	14, 31	4.9	3.8
Boonville, Mo	199	20	9.7	5	5.5	15	7.5	4.2
Hermann, Mo	103	24	13.6	5	6.1	16	8.9	7.5
Minnesota River.								
Mankato, Minn	127	18	3.5	1-6	3.0	26-29	3.3	0.5
St. Croix River.								
Stillwater, Minn. (31)	23	11	......	......	......	......	......	......
Red Cedar River.								
Cedar Rapids, Iowa	77	14	4.5	22	2.8	3, 4, 10-14	3.2	1.7
Iowa River.								
Iowa City, Iowa (31)	57		......	......	......	......	......	......
Des Moines River.								
Des Moines, Iowa. (12)	205	19	3.1	1	2.4	30, 31	2.9	0.7
Illinois River.								
La Salle, Ill	197	18	19.4	31	12.9	1	16.3	6.5
Peoria, Ill	135	14	14.0	31	8.8	1	10.4	5.2
Red Bank Creek.								
Brookville, Pa	42	8	1.2	24	0.7	2, 3, 8-22	0.8	0.5
Clarion River.								
Clarion, Pa	32	10	7.0	24	2.5	16, 17	3.6	4.5
Conemaugh River.								
Johnstown, Pa	64	7	11.0	23	2.0	2	3.3	9.0
Allegheny River								
Warren, Pa	177	14	6.9	23	1.5	15	3.3	5.4
Franklin, Pa	114	15	8.6	24	2.4	11, 12	4.3	6.2
Parker, Pa	73	20	9.0	24	2.4	11, 13	4.6	6.6
Freeport, Pa	29	20	15.8	24	6.8	31	9.5	9.0
Springdale, Pa	17	27	19.0	24	8.8	11	12.2	10.2
Cheat River.								
Rowlesburg, W. Va	36	14	8.9	23	1.9	3	3.6	7.0
Youghiogheny River.								
Confluence, Pa	59	10	9.0	23	1.5	1-3, 22	2.5	7.5
West Newton, Pa	15	23	12.8	23	1.7	11	3.1	11.1
Monongahela River.								
Weston, W. Va	161	18	6.4	23	0.0	1, 2, 22, 29, 30	1.0	6.4
Fairmont, W. Va	119	25	21.9	23	15.3	2, 3, 12	16.6	6.6
Greensboro, Pa	81	18	18.0	24	7.8	3, 11	9.9	10.2
Lock No. 4, Pa	40	28	23.0	24	7.9	11, 12	11.4	15.1
Beaver River.								
Ellwood Junction, Pa. (4)	10	14	3.8	4	2.0	31	2.9	1.8
Muskingum River.								
Zanesville, Ohio	70	25	14.5	6	9.3	30, 31	11.0	5.2
Beverly, Ohio	20	25	12.8	16	6.4	31	8.7	6.4
Little Kanawha River.								
Glenville, W. Va	77	20	12.0	23	0.6	2, 31	2.4	11.4
Creston, W. Va	38	20	12.4	23	2.9	11	5.5	9.5
New River.								
Radford, Va	155	14	12.0	23	0.9	22	2.6	11.1
Hinton, W. Va	95	14	*13.8	23	2.2	3	4.3	11.6
Great Kanawha River.								
Charleston, W. Va	58	30	27.6	24	4.6	12	8.5	23.0
Scioto River.								
Columbus, Ohio. (3)	110	17	6.0	16	3.0	30, 31	4.1	3.0
Licking River.								
Falmouth, Ky	30	25	16.0	3	2.5	31	5.0	13.5
Miami River.								
Dayton, Ohio	77	18	5.3	16	2.1	2	3.2	3.2
Kentucky River.								
Jackson, Ky	287	24	8.3	14	5.0	1, 2, 8, 10, 11, 19-22, 24-26, 30, 31	5.4	3.3
Beattyville, Ky	254	30	4.9	15	0.9	30, 31	2.0	4.0
High Bridge, Ky	117	17	14.7	15, 16	10.2	27	11.7	4.5
Frankfort, Ky	65	31	10.3	16	6.8	30	7.8	3.5
Wabash River.								
Terre Haute, Ind	171	16	20.0	26, 27	3.2	14, 15	8.8	16.8
Mount Carmel, Ill	75	15	16.9	27-29	6.8	2	11.9	10.1
Cumberland River.								
Burnside, Ky	518	50	15.5	15	3.3	3	7.5	12.2
Celina, Tenn	383	45	17.9	16	6.0	3	11.3	11.9
Carthage, Tenn	308	40	19.0	23	5.7	3	11.0	13.3
Nashville, Tenn	193	40	30.9	23	11.7	3	17.6	19.2
Clarksville, Tenn	126	42	30.9	24	13.6	4	19.0	17.3
Powell River.								
Tazewell, Tenn	44	20	5.8	5	1.1	1, 2	2.5	4.7
Clinch River.								
Speers Ferry, Va	156	20	10.0	23	0.0	2	2.0	10.0
Clinton, Tenn	52	25	13.0	25	5.0	3	8.7	8.0
South Fork Holston River.								
Bluff City, Tenn	35	15	11.6	23	0.9	2, 3	2.5	10.7
Holston River.								
Rogersville, Tenn	103	14	17.5	23	1.9	3	3.8	15.6
French Broad River.								
Asheville, N. C	144	6	7.8	23	0.2	2	2.0	7.6
Leadvale, Tenn	70	15	14.0	23	0.7	2	3.5	13.3
Dandridge, Tenn	46	15	15.0	23	1.2	3	3.5	13.8
Little Tennessee River.								
McGhee, Tenn	17	20	14.0	23	3.7	2	5.7	10.3
Hiwassee River.								
Charleston, Tenn	18	22	13.0	4	2.0	2	4.8	11.0
Tennessee River.								
Knoxville, Tenn	635	29	22.4	24	1.9	2, 3	5.6	20.5
Loudon, Tenn	590	25	17.0	25	2.2	3	5.8	14.8
Kingston, Tenn	556	25	14.7	25	3.0	3	6.1	11.7
Chattanooga, Tenn	452	33	21.5	26	5.0	3	9.8	16.5
Bridgeport, Ala	402	24	15.6	27	3.6	3	7.6	12.0
Guntersville, Ala	349	31	22.6	26	6.9	3	12.8	15.7
Florence, Ala	255	16	13.7	28	4.9	3	8.6	8.8
Riverton, Ala	225	26	22.2	25, 29	8.5	3	13.9	13.7
Johnsonville, Tenn	95	21	22.2	26	9.0	3	13.9	13.2
Ohio River.								
Pittsburg, Pa	966	22	18.6	24	3.3	11	7.8	15.3
Davis Island Dam, Pa	960	25	17.9	24	5.5	11	9.3	12.4
Beaver Dam, Pa	925	27	23.3	25	7.4	12	12.7	15.9
Wheeling, W. Va	875	36	24.3	25	7.0	12, 13	12.6	17.3
Parkersburg, W. Va	785	36	22.9	26	9.0	12, 13	14.1	13.9
Point Pleasant, W. Va	703	39	29.7	26	10.0	13	18.3	19.7
Huntington, W. Va	660	50	33.0	26	14.5	13	22.7	18.5
Catlettsburg, Ky	651	50	33.8	26	14.0	1	23.0	19.8
Portsmouth, Ohio	612	50	33.7	27	15.2	1	24.2	18.5
Maysville, Ky	559	50	32.9	27	15.1	2	24.0	17.8
Cincinnati, Ohio	499	50	35.0	28	17.2	3	26.8	17.8
Madison, Ind	413	46	28.0	28	16.1	3	23.2	11.9
Louisville, Ky	367	28	10.8	29	7.1	3	9.3	3.7
Evansville, Ind	184	35	27.0	31	18.0	3	23.0	9.0
Mount Vernon, Ind	148	35	26.7	31	17.6	3	22.5	9.1
Paducah, Ky	47	40	30.6	27	19.4	3	24.2	11.2
Cairo, Ill	1	45	36.2	27, 28	24.7	3	29.8	11.5
St. Francis River.								
Marked Tree, Ark	104	17	16.7	30, 31	12.7	1-6	13.8	4.0
Neosho River.								
Neosho Rapids, Kans	326	22	1.2	1-16	1.0	25-31	1.1	0.2
Iola, Kans	262	10	0.9	4	0.3	24-31	0.4	0.6
Oswego, Kans	184	20	6.9	3	0.5	20-25	1.5	6.4
Fort Gibson, Ind. T	3	22	18.0	6	10.8	23-25	12.3	7.2
Canadian River.								
Calvin, Ind. T	99	10	3.7	4, 18	2.8	24	3.2	0.9
Black River.								
Blackrock, Ark	67	12	24.0	23, 24	8.0	1, 2	15.9	16.0
White River.								
Calicorock, Ark	272	15	17.8	23	3.0	20	7.4	14.8
Batesville, Ark	217	18	22.3	23	5.1	20	10.3	17.2
Newport, Ark	185	26	26.8	27	9.4	2	18.4	17.4
Clarendon, Ark	75	30	29.0	31	22.7	1	25.9	6.3
Arkansas River.								
Wichita, Kans	832	10	1.3	22	— 0.7	10, 11	0.0	2.0
Tulsa, Ind. T. (1)	551	16	3.1	4, 5	2.6	30, 31	2.8	0.5
Webbers Falls, Ind. T	465	23	10.0	5, 6	5.4	17-19	6.6	4.6
Fort Smith, Ark	403	22	13.1	6	4.5	20	7.8	8.6
Dardanelle, Ark	256	21	15.0	22	4.7	20	8.6	10.3
Little Rock, Ark	176	23	17.1	24	6.6	20	11.1	10.5
Yazoo River.								
Greenwood, Miss	175	38	17.1	30	12.9	22	15.3	4.2
Yazoo City, Miss	80	25	14.0	31	10.4	2	12.5	3.6
Ouachita River.								
Camden, Ark	304	39	33.4	27, 28	11.7	22	24.6	21.7
Monroe, La	122	40	34.3	31	25.7	1	30.1	8.6
Red River								
Denison, Tex	768	22	2.8	5	0.9	21, 22, 30, 31	1.4	1.9
Arthur City, Tex	688	27	13.7	24	6.3	21, 22	8.9	7.4
Fulton, Ark	515	28	24.7	26, 27	11.0	21	18.4	13.7
Shreveport, La	327	29	22.6	1-3	12.2	21	17.8	10.4
Alexandria, La	118	33	29.7	6	20.7	23	26.1	9.0
Mississippi River.								
St. Paul, Minn. (31)	1,954	14	......	......	......	......	......	......
Red Wing, Minn. (31)	1,914	14	......	......	......	......	......	......
Reeds Landing, Minn. (11)	1,884	12	3.5	12-14, 16	2.6	28-31	3.0	0.9
La Crosse, Wis. (31)	1,819	12	......	......	......	......	......	......
Prairie du Chien, Wis. (31)	1,759	18	......	......	......	......	......	......
Dubuque, Iowa. (31)	1,699	18	......	......	......	......	......	......
Clinton, Iowa. (31)	1,629	16	......	......	......	......	......	......
Leclaire, Iowa. (31)	1,609	10	......	......	......	......	......	......
Davenport, Iowa	1,593	15	6.0	23, 24	3.2	13, 15	4.5	2.8
Muscatine, Iowa	1,562	16	7.5	25	4.5	2, 3	5.7	3.0
Galland, Iowa	1,472	8	3.8	26, 27	1.9	15	2.7	1.9
Keokuk, Iowa	1,463	15	7.2	26	3.0	17	4.5	4.2
Warsaw, Ill	1,458	18	10.3	22	6.1	2	7.7	4.2
Hannibal, Mo	1,402	13	8.3	23	3.9	18, 19	5.5	4.4
Grafton, Ill	1,306	23	10.3	31	6.1	11	7.8	4.2
St. Louis, Mo	1,264	30	16.2	6	6.8	2	10.5	9.4
Chester, Ill	1,189	30	14.0	7	6.4	19	9.8	7.6
Cape Girardeau, Mo	1,128	28	18.6	8	11.0	20	14.7	7.6
Luxora, Ark (*)	1,003	34	29.2	29, 30	20.2	3	24.1	9.0
New Madrid, Mo	905	33	22.7	28	13.4	6	17.5	9.3
Memphis, Tenn	843	33	27.2	31	17.0	5	20.9	10.2
Helena, Ark	767	42	35.6	31	24.3	6, 7	28.4	11.3
Arkansas City, Ark	635	42	39.4	31	28.3	1	32.7	11.1
Greenville, Miss	595	42	33.3	31	23.4	1	27.5	9.9

TABLE VI.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Vicksburg, Miss	474	45	35.2	31	24.4	1	29.7	10.8
Natchez, Miss	373	46	35.3	31	25.8	1	31.0	9.5
Baton Rouge, La	240	35	26.0	31	19.2	1	23.4	6.8
Donaldsonville, La	188	28	20.3	31	14.7	1	18.0	5.6
New Orleans, La	108	16	13.3	22	9.2	1	11.5	4.1
Atchafalaya River.								
Simmesport, La	127	33	30.8	31	24.1	1	28.2	6.7
Melville, La	103	31	30.9	31	26.5	1	29.3	4.4
Morgan City, La	19	8	5.3	3	2.0	9, 24	3.5	3.3
Grand River.								
Grand Rapids, Mich	38	11	11.5	25	1.7	7	4.7	9.8
Sandusky River.								
Tiffin, Ohio	65	8	2.2	5	0.6	12-14, 28-31	1.0	1.6
Maumee River.								
Napoleon, Ohio [5]	44	13	2.7	24	0.0	4, 5	1.1	2.7
Penobscot River.								
Mattawamkeag, Me. [31]	87	..	......	......	......	......	......	......
West Enfield, Me. [31]	60	..	......	......	......	......	......	......
Kennebec River.								
Winslow, Me	46	......	5.7	25	2.0	15	3.9	3.7
Merrimac River.								
Franklin Junction, N. H. (b)	110	......	9.9	25	4.4	14	5.4	5.5
Concord, N. H. [25]	94	......	......	......	......	......	......	......
Manchester, N. H	68	......	4.3	24	0.8	30	3.1	3.5
Connecticut River.								
Wells River, Vt. [26]	255	......	......	......	......	......	......	......
Whiteriver Junction, Vt	209	......	14.5	24	5.4	21	7.3	9.1
Bellows Falls, Vt. [5]	170	12	8.2	24	2.1	31	3.0	6.1
Holyoke, Mass	84	9	6.7	25	0.9	12	2.6	5.8
Hartford, Conn	50	13	14.3	26	4.2	7	6.5	10.1
Housatonic River.								
Gaylordsville, Conn	44	15	5.8	25	4.1	10	4.8	1.7
Mohawk River.								
Utica, N. Y. (a)	98	6	12.9	24	2.7	10	5.1	10.2
Tribeshill, N. Y	42	12	6.8	24	1.0	9-11, 19, 20, 31	2.0	5.8
Schenectady, N. Y	19	15	8.5	24	1.2	12	2.6	7.3
Hudson River.								
Glens Falls, N. Y	197	8	6.7	25	4.0	11, 12	4.9	2.7
Troy, N. Y	154	14	8.3	28	3.2	21	4.9	5.1
Albany, N. Y	147	12	8.8	25	1.6	3	4.1	7.2
Stuyvesant, N. Y	128	9	4.5	31	− 1.0	7	1.8	5.5
Pompton River.								
Pompton Plains, N. J	6	8	4.8	5	4.3	3, 12-15	4.5	0.5
Lehigh River.								
Mauchchunk, Pa. [5]	45	15	5.9	24	4.6	2-4, 16-22	4.8	1.3
Schuylkill River.								
Reading, Pa	66	12	2.5	5	1.0	3, 11	1.4	1.5
Delaware River.								
Hancock (E. Branch), N. Y	269	12	7.3	24	3.2	10	4.1	4.1
Hancock (W. Branch), N. Y.	269	10	6.7	24	3.1	9	4.4	3.6
Port Jervis, N. Y	204	14	4.8	25	0.9	10, 12	1.9	3.9
Phillipsburg, N. J. [5]	142	26	7.8	25	2.3	23	3.8	5.5
Trenton, N. J	92	18	5.8	12	2.2	10, 11, 23	3.1	3.6
North Branch Susquehanna.								
Binghamton, N. Y	183	16	9.6	24	2.7	10	4.0	6.9
Towanda, Pa	139	16	9.1	24	2.0	21	3.4	7.1
Wilkes-Barre, Pa	60	17	14.9	25	5.1	18, 19	7.1	9.8
West Branch Susquehanna.								
Clearfield, Pa	165	8	4.3	24	1.4	14, 15	2.3	2.9
Renovo, Pa. [3]	90	16	9.5	24	2.0	17	4.2	7.5
Williamsport, Pa	39	20	11.5	24	2.8	12	4.9	8.7
Juniata River.								
Huntingdon, Pa	90	24	6.7	23	4.0	2, 3, 14, 15	4.6	2.7
Susquehanna River.								
Selinsgrove, Pa	116	17	8.3	25	1.7	13, 14	3.3	6.6
Harrisburg, Pa	69	17	9.4	26	3.0	13	4.6	6.4
Shenandoah River.								
Riverton, Va	58	22	0.0	8	− 0.6	4, 5	−0.4	0.6
Potomac River.								
Cumberland, Md	290	8	7.0	23	3.0	16-22	3.9	4.0
Harpers Ferry, W. Va	172	18	9.5	5	2.8	12, 13	4.4	6.7
James River.								
Buchanan, Va	305	12	9.7	24	3.3	3, 22	4.7	6.4
Lynchburg, Va	260	18	8.2	24	1.8	11-15, 21, 22	3.0	6.4
Columbia, Va	167	18	20.1	4	5.0	3, 14, 22, 23	8.1	15.1
Richmond, Va	111	12	10.1	5	0.4	21	2.2	9.7
Dan River.								
Danville, Va	55	8	7.7	4	0.2	20, 21	1.3	7.5
Staunton River.								
Randolph, Va	26	28	25.0	5	6.3	18	9.3	18.7
Roanoke River.								
Clarksville, Va	196	12	11.0	6	0.9	22	3.2	10.1
Weldon, N. C	129	30	37.3	7	11.1	23	18.2	26.2
Tar River.								
Tarboro, N. C	46	25	16.8	8	5.6	26	9.8	11.2
Greenville, N. C	21	22	13.6	8, 9	7.1	24	10.3	6.5
Haw River.								
Moncure, N. C	171	25	22.8	4	5.4	22	10.4	17.4
Cape Fear River.								
Fayetteville, N. C	112	38	38.5	5	7.0	22, 23	17.4	31.5
Waccamaw River.								
Conway, S. C	40	7	6.2	29-31	4.0	25	5.0	2.2
Pedee River.								
Cheraw, S. C	149	27	31.5	5	4.1	22	14.9	27.4
Smiths Mills, S. C	51	16	16.2	13	11.3	26	13.9	4.9
Lynch Creek.								
Effingham, S. C	35	12	13.0	29	6.0	23-25	9.5	7.0
Black River.								
Kingstree, S. C	45	12	10.5	30, 31	7.0	22-24	8.1	3.5
Catawba River.								
Mount Holly, N. C	28	15	10.0	24	2.2	10-12	3.2	7.8
Wateree River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Camden, S. C	37	24	28.5	25	8.3	22	16.8	20.2
Broad River.								
Blairs, S. C	36	14	15.6	5	2.2	2	5.3	13.4
Saluda River.								
Chappels, S. C	56	14	18.0	6	4.1	22	9.5	13.9
Congaree River.								
Columbia, S. C	52	15	17.5	5	1.6	21	6.5	15.9
Santee River.								
St. Stephens, S. C	50	12	11.7	13	8.8	27, 28	9.5	2.9
Edisto River.								
Edisto, S. C	75	6	5.4	29-31	3.4	22	4.5	2.0
Broad River.								
Carlton, Ga	30	11	19.0	23	2.5	21	5.0	16.5
Savannah River.								
Calhoun Falls, S. C	347	15	11.0	23	3.2	21	5.0	7.8
Augusta, Ga	268	32	29.6	5	9.8	21	15.8	19.8
Oconee River.								
Milledgeville, Ga	147	25	25.4	24	4.0	21	9.4	21.4
Dublin, Ga	79	30	19.2	28	3.4	22	9.2	15.8
Ocmulgee River.								
Macon, Ga	203	18	19.9	23	4.7	20, 21	8.6	15.2
Abbeville, Ga	96	11	14.9	29	7.2	23	10.2	7.7
Flint River.								
Woodbury, Ga	227	10	6.3	24	1.3	1, 2, 18-21	2.6	5.0
Montezuma, Ga	152	20	15.0	26	6.0	21	9.5	9.0
Albany, Ga	90	20	18.1	27	5.8	21	10.8	12.3
Bainbridge, Ga	29	22	19.2	27, 28	9.4	21, 22	13.2	9.8
Chattahoochee River.								
Oakdale, Ga	305	18	21.5	5	3.0	1, 21	6.4	18.5
West Point, Ga	239	20	13.6	24	3.5	2	6.3	10.1
Eufaula, Ala	90	40	32.5	25	5.0	18-21	13.4	27.5
Alaga, Ala	30	25	27.6	25	7.9	2	13.9	19.7
Coosa River.								
Rome, Ga	271	30	22.0	5	3.2	2	7.9	18.8
Gadsden, Ala	144	22	18.7	7	5.0	2	9.3	13.7
Lock No. 4, Ala	116	17	13.7	6, 7	4.6	2	8.0	9.1
Wetumpka, Ala	6	45	27.5	6	9.8	3	16.7	17.7
Tallapoosa River.								
Milstead, Ala	38	35	26.2	5	3.7	19	7.6	22.5
Alabama River.								
Montgomery, Ala	265	35	26.0	6, 7	6.2	19, 20	13.9	19.8
Selma, Ala	212	35	29.0	8	9.7	20, 21	17.4	19.3
Black Warrior River.								
Tuscaloosa, Ala	90	43	53.6	24	12.4	21	24.1	41.2
Tombigbee River.								
Columbus, Miss	303	33	10.4	8	1.4	20	5.3	9.0
Vienna, Ala	233	42	15.3	6	5.4	20	10.3	9.9
Demopolis, Ala	155	35	35.6	29	12.6	21	24.6	23.0
Leaf River.								
Hattiesburg, Miss. (b)	60	20	12.8	5	4.5	20	7.8	8.3
Chickasawhay River.								
Enterprise, Miss	144	18	11.0	4	3.0	31	5.6	8.0
Shubuta, Miss	106	25	20.8	23	7.0	31	11.3	13.8
Pascagoula River.								
Merrill, Miss	78	20	16.0	27, 28	6.9	21	12.5	9.1
Pearl River.								
Jackson, Miss	242	20	14.5	26	6.4	1	10.6	8.1
Columbia, Miss	110	14	15.0	24, 25	9.0	19	11.3	6.0
Sabine River.								
Logansport, La	315	25	29.6	5	16.2	21	24.8	13.4
Neches River.								
Rockland, Tex	105	20	15.5	8, 9, 11	7.0	20	12.9	8.5
Beaumont, Tex	18	10	3.7	21	1.6	29	2.7	2.1
Trinity River.								
Dallas, Tex	320	25	15.2	5	5.6	20	7.1	9.6
Long Lake, Tex	211	35	37.8	1	10.7	21	21.5	27.1
Riverside, Tex	112	40	28.9	5, 6	6.4	20	18.1	22.5
Liberty, Tex	20	25	25.0	12, 13	11.2	22	20.6	13.8
Brazos River.								
Kopperl, Tex	345	21	0.2	1-10	0.0	11-31	0.1	0.2
Waco, Tex	285	24	3.8	4	3.0	20, 21, 25-31	3.3	0.8
Valley Junction, Tex	215	40	5.9	23	1.7	18-20	2.9	4.2
Hempstead, Tex	140	40	9.0	4, 22	1.4	20, 21	4.8	7.6
Booth, Tex	61	39	6.9	27	4.3	19, 20	5.4	2.6
Colorado River.								
Ballinger, Tex	489	21	1.7	1-26	1.5	27-31	1.7	0.2
Austin, Tex	214	18	1.5	1-4	1.3	11-17, 30, 31	1.4	0.2
Columbus, Tex	98	24	7.8	22	6.5	27-29	6.8	1.3
Guadalupe River.								
Gonzales, Tex	112	22	0.9	18, 19, 22	0.7	7, 14, 15, 25, 27, 28	0.8	0.2
Victoria, Tex	35	16	2.1	23	1.7	28, 29	1.9	0.4
Red River of the North.								
Moorhead, Minn. [31]	284	26	......	......	......	......	......	......
Kootenai River.								
Bonners Ferry, Idaho. [31]	123	24	......	......	......	......	......	......
Pend d'Oreille River.								
Newport, Wash	86	14	− 1.4	29-31	− 1.8	21, 22	−1.6	0.4
Snake River.								
Lewiston, Idaho	144	24	1.5	27	0.4	6	1.0	1.1
Riparia, Wash	67	30	2.1	25-31	1.4	7	1.8	0.7
Columbia River.								
Wenatchee, Wash	473	40	4.8	29-31	3.7	1, 2, 8	4.1	1.1
Umatilla, Oreg	270	25	1.6	28-30	0.1	12-14	0.6	1.5
The Dalles, Oreg	166	40	1.2	30, 31	− 0.6	12, 15	0.0	1.8
Willamette River.								
Albany, Oreg	118	20	14.2	18	5.0	5-8	7.8	9.2
Salem, Oreg	84	20	12.4	18	4.1	6-8	7.1	8.3
Portland, Oreg	12	15	7.9	19, 25	2.5	4	5.2	5.4
Sacramento River.								
Red Bluff, Cal	201	23	25.3	19	0.7	6-8	5.0	21.6
Sacramento, Cal	64	25	23.0	19	7.0	8	15.2	16.0

Figures after names of stations indicate number of days frozen. (a) 26 days only. (b) 30 days only.

Honolulu, T. H., latitude, 21° 19′ north, longitude 157° 52′ west; barometer above sea, 38 feet; gravity correction, —.057 applied. January, 1906.

Day.	Pressure.*		Air temperature.				Moisture.				Wind.				Precipitation.		Clouds.					
							8 a. m.		8 p. m.		8 a. m.		8 p. m.				8 a. m.			8 p. m.		
	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Maximum.	Minimum.	Wet.	Relative humidity.	Wet.	Relative humidity.	Direction.	Velocity.	Direction.	Velocity.	8 a. m.	8 p. m.	Amount.	Kind.	Direction.	Amount.	Kind.	Direction.
1	30.10	30.07	75.0	74.0	79	69	66.6	64	67.2	70	e.	16	e.	10	0.02	T.	2	S.-cu.	e.	3	S.-cu.	e.
2	30.08	30.08	72.3	72.8	78	66	67.2	77	67.0	74	n.	2	ne.	3	T.	0.07	1	Cu.	e.	4	S.-cu.	ne.
3	30.09	30.10	74.3	72.7	77	69	66.1	64	65.0	66	se.	6	ne.	6	0.03	0.03	2 3	Cu. S.-cu.	e. e.	3 3	Cu. S.-cu.	e. e.
4	30.12	30.08	74.0	72.5	78	70	66.1	65	63.5	61	e.	14	e.	23	0.01	0.00	2 1	Cu. S.-cu.	e. 0.	1	S.-cu.	e.
5	30.10	30.06	73.4	72.0	77	70	64.9	63	63.4	63	ne.	16	ne.	8	0.00	0.00	1	Cu.	e.	1	S.-cu.	e.
6	30.11	30.07	73.4	73.0	77	69	63.6	58	65.1	65	ne.	15	e.	11	0.00	0.00	1 1	Cu. S.-cu.	e. e.	4	Cu.	e.
7	30.13	30.12	73.9	73.0	77	70	65.9	65	65.0	65	e.	14	e.	16	0.00	T.	5	S.-cu.	e.	1 5	S.-cu. S.-cu.	e. e.
8	30.15	30.13	73.4	72.9	76	68	62.1	52	65.0	65	e.	13	e.	7	0.00	0.00	7	S.-cu.	e.	2 6	Cu. S.-cu.	e. e.
9	30.16	30.10	69.0	71.7	73	68	67.0	90	64.2	67	ne.	7	ne.	5	0.01	0.08	2 6	S.-cu. N.	e. e.	3 2	Cu. S.-cu.	e. e.
10	30.08	30.05	71.4	71.1	76	67	64.2	68	62.5	62	e.	11	e.	3	0.00	0.00	1 2	Cu. S.-cu.	e. e.	2 6	Cu. S.-cu.	e. e.
11	30.05	30.03	72.5	72.1	77	69	62.7	58	65.1	69	e.	12	ne.	3	0.00	0.00	3	S.-cu.	e.	1 6	Cu. S.-cu.	e e.
12	30.06	30.00	71.2	71.4	77	68	65.2	72	64.2	68	ne.	4	ne.	4	0.00	0.00	8	S.-cu.	e.	9	S.-cu.	n.
13	30.02	29.94	72.2	72.5	77	65	64.7	67	64.2	64	n.	2	e.	3	0.00	0.00	4 1	Ci.-cu. A.-cu.	w. w.	10	S.-cu.	0
14	29.88	29.77	68.0	72.0	76	66	66.5	92	70.1	91	se.	6	w.	11	0.02	0.29	10	S.-cu.	se.	10	N.	0
15	29.69	29.72	73.2	67.5	74	64	68.4	79	62.0	74	w.	22	n.	14	0.17	0.03	5 2	A.-cu. S.-cu.	w. w.	2	S.-cu.	w.
16	29.80	29.81	64.5	64.8	71	60	56.4	60	57.5	64	n.	5	nw.	6	0.00	0.00	4	A.-cu.	nw.	4	S.-cu	nw.
17	29.82	29.81	66.1	65.0	73	59	59.9	70	59.8	74	n.	4	n.	5	0.00	T.	1	Cu.	0	3	S.-cu.	nw.
18	29.80	29.59	70.5	73.8	75	62	63.7	69	65.5	64	sw.	13	s.	28	0.00	T.	2 2	Cu. S.-cu.	w. w.	9	S.-cu.	s.
19	29.68	29.75	63.4	70.2	71	60	59.9	82	62.2	64	nw.	8	w.	25	0.35	0.00	10	S.-cu.	w.	4	S.-cu.	w.
20	29.79	29.77	70.5	72.3	74	65	63.0	66	63.1	60	w.	22	sw.	24	0.10	0.00	1 3	Cu. S.-cu.	w. w.	4	S.-cu.	w.
21	29.83	29.88	71.0	68.5	73	63	63.4	66	62.0	70	w.	12	nw.	5	0.08	T.	7	S.-cu.	w.	few.	S.-cu.	?
22	29.92	29.93	67.2	66.3	73	61	61.0	70	61.3	75	n.	2	n.	7	0.00	0.00	9	S.-cu.	w.	1	S.-cu.	?
23	29.98	29.97	68.0	69.6	74	62	62.3	73	63.5	72	ne.	4	ne.	5	0.00	0.00	few.	S.-cu.	0	3 2	Ci.-s. S.-cu.	w. 0
24	29.95	29.91	70.1	70.6	75	64	64.2	72	64.5	72	e.	5	n.	4	0.00	0.00	1	Cu.	e.	4	S.-cu.	sw.
25	29.93	29.93	70.4	70.0	76	66	64.6	73	65.0	77	ne.	4	n.	2	0.00	T.	few.	S.-cu.	sw.	10	S.-cu.	0
26	29.95	29.94	73.4	73.6	77	67	65.0	63	66.5	69	ne.	3	se.	2	0.00	0.00	1	Ci.-cu.	0	9	S.-cu.	0
27	30.02	30.04	68.5	72.8	77	65	64.9	82	68.3	80	nw.	7	s.	8	0.82	0.05	10	Cu.	s.	5 4	A.-Cu. S.-cu.	sw. 0
28	30.06	30.01	73.0	70.2	79	65	66.5	71	65.4	78	ne.	1	ne.	2	0.00	0.04	few.	S.-cu.	0	few.	S.-cu.	0
29	30.01	29.96	71.1	70.2	75	64	65.5	74	60.3	81	0	0	w.	3	0.00	0.00	few.	S.-cu.	0	3 2	A.-cu. S.-cu.	w. w.
30	30.02	30.02	67.0	63.4	71	60	59.2	63	54.0	53	nw.	16	n.	7	0.01	0.00	5 1	A.-s. Cu.	w. nw.	1	S.-cu.	nw.
31	30.03	30.02	65.0	65.0	69	60	54.0	48	55.5	54	n.	15	ne.	7	T.	0.00	1 5	Cu. S.-cu.	ne. ne.	2	Cu.	n.
Mean	29.981	29.957	70.5	70.6	75.2	65.2	63.7	68.9	63.7	68.7	ne.	9.1	ne.	8.5	1.62	0.59	4.3	S.-cu.	e.	5.0	S.-cu.	e.

Observations are made at 8 a. m. and 8 p. m., local standard time, which is that of 157° 30′ west, and is 5h and 30m slower than 75th meridian time. *Pressure values are reduced to sea level and standard gravity.

RAINFALL IN JAMAICA.

Through the kindness of Mr. H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following table.

Comparative table of rainfall.

[Based upon the average stations only.]

JANUARY, 1906.

Divisions.	Relative area.	Number of stations.	Rainfall. 1906.	Rainfall. Average.
	Per cent.		*Inches.*	*Inches.*
Northeastern division	25	18	4.13	6.39
Northern division	22	44	3.38	3.97
West-central division	26	24	3.31	2.92
Southern division	27	36	2.67	1.94
Means	100		3.37	3.81

The rainfall for January was therefore below the average for the whole island. The greatest fall, 8.89 inches, occurred at Buff Bay, in the northeastern division, while the least, 0.12 inch, was recorded at Ballast Ground, in the southern division.

COSTA RICAN CLIMATOLOGICAL DATA.

Under date of San José, March 3, the Director of the National Observatory, Mr. Anastasio Alfaro, writes:

After the departure of the former director, Mr. Pittier, it was found necessary to leave the meteorological service for a time to assistants who lacked the necessary scientific training. This I hope will not occur again. Henceforward you will regularly receive accurate monthly reports from this institution. The following data are prepared by Señor Pedro Nolasco Gutiérrez, assistant at the National Observatory at San José. (Altitude 3835 feet; latitude 9° 56′ 1″ N.; longitude 84° 4′ 10″ W.)

JANUARY, 1906.

Temperature:	°F.
Mean	67.3
Average of daily maxima	78.4
Average of daily minima	59.9
Highest temperature of the month	86.0
Lowest temperature of the month	53.2
Pressure:[1]	Inches.
Mean	26.22
Maximum	26.31
Minimum	26.12
Relative humidity:	Per cent.
Mean	73.7
Maximum	97.0
Minimum	42.0
Evaporation:	Inches.
Total for January	62.5
Maximum, daily	2.7
Minimum, daily	1.2
Rainfall (total for the month)	0.03 inches.
Sunshine	203.23 hours.
Mean velocity of wind per hour	4.0 miles.
Prevailing direction of wind	Northeast.
Earthquakes:	
Number	37
Mean intensity[2]	II
Maximum intensity[2]	III

Notes on earthquakes.—During the month previous (December, 1905,) an extraordinary increase of seismic activity began not only in Costa Rica, but also in the countries north and south of ours. In Costa Rica the greatest earthquake of the season occurred on December 27 at 6:59 p. m. In the city of Cartago many walls were cracked. The intensity of that particular earthquake decreased rapidly around the above-named city. Its direction in San José was east-northeast.

[1] As to the reduction to standard gravity nothing is said.
[2] Probably on the Rossi-Forel scale.